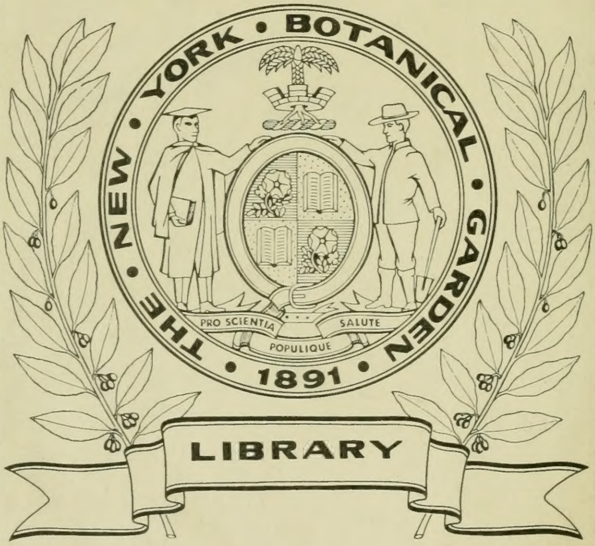
SHOUT
SHARE
IT

XU
.N674

Vol. 4
1896/98



THE NEW YORK BOTANICAL GARDEN
1891
PRO SCIENTIA POPULIQUE SALUTE

LIBRARY

BULLETIN

FROM THE

LABORATORIES OF NATURAL HISTORY

OF THE

STATE UNIVERSITY OF IOWA.

VOLUME IV.

PUBLISHED

BY AUTHORITY OF THE REGENTS.

IOWA CITY, IOWA:

XU
.N674
Vol.4
1896/98

TABLE OF CONTENTS.

VOLUME IV.

Actiniaria Collected by Bahama Expedition of the State University of Iowa, 1893, Report on the, . . . *McMurrich, J. Playfair,* 225
American Uredineæ, Description of, Pt. II., ... *Arthur, J. C., and Holway, E. W. D.,* 377
Arthur, J. C., and Holway, E. W. D., ... 377
Ashmead, Wm. H., ... 28
Beetles of Southern Arizona, The, ... *Wickham, H. F.,* 295
Brachyura of the Biological Expedition to the Florida Keys and the Bahamas in 1893, The, ... *Rathbun, Mary J.,* 250
Coleoptera of the Lower Rio Grande Valley, The, *Wickham, H. F.,* 96
Cratty, R. I., ... 313
Dall, Wm. H., ... 12
Ellis, J. B., and Everhart, B. M., ... 67
Ferns of Nicaragua, The, ... *Shimek, B.,* 116
Fishes Collected on the Bahama Expedition, Report on the, ... *Garman, S.* 76
Garman, S., ... 76
Hymenoptera of the Bahama Expedition, Notes on the, ... *Ashmead, Wm. H.,* 28
Iowa Sedges, The, ... *Cratty, R. I.,* 313
Macbride, T. H., and Smith, C. L., ... 73
Macbride, T. H., and Allin, Norra, ... 33
McMurrich, J. Playfair, ... 225
Mollusks and Brachiopods of the Bahama Expedition, The, ... *Dall, Wm. H.,* 12
Nicaraguan Myxomycetes with Notes on Certain Mexican Species, ... *Macbride, T. H., and Smith, C. L.,* 73
Nicaraguan Shell-bank, A, ... *Shimek, B.,* 94
Nutting, C. C., ... 1
Plymouth Hydroids, Notes on, ... *Nutting, C. C.,* 1
Rathbun, Mary J., ... 250
Saprophytic Fuugi of Eastern Iowa, The Puff Balls, ... *Macbride, T. H., and Allin, Norra,* 33
Shimek, B., ... 94, 116
Tropical Fungi, New Species of, . *Ellis, J. B., and Everhart, B. M.,* 67
Wickham, H. F., ... 97, 295

[illegible]

From
T. H. Macbride

PRICE, FIFTY CENTS.

VOL. IV. NO. 1.

BULLETIN
FROM THE
LABORATORIES OF NATURAL HISTORY
OF THE
STATE UNIVERSITY OF IOWA.

I. *NOTES ON PLYMOUTH HYDROIDS,* C. C. NUTTING.

II. *THE MOLLUSKS AND BRACHIOPODS OF THE BAHAMA EXPEDITION,* WM. H. DALL.

III. *NOTES ON THE HYMENOPTERA OF THE BAHAMA EXPEDITION,* WM. H. ASHMEAD.

IV. *THE SAPROPHYTIC FUNGI OF EASTERN IOWA: THE PUFF-BALLS,* T. H. MACBRIDE, NORRA ALLIN.

V. *NEW SPECIES OF TROPICAL FUNGI,* J. B. ELLIS. B. M. EVERHART.

VI. *THE NICARAGUAN MYXOMYCETES, WITH NOTES ON CERTAIN MEXICAN SPECIES,* T. H. MACBRIDE. C. L. SMITH.

VII. *REPORT ON THE FISHES COLLECTED BY THE BAHAMA EXPEDITION,* S. GARMAN.

VIII. *A NICARAGUAN SHELL-BANK,* B. SHIMEK.

PUBLISHED
BY AUTHORITY OF THE REGENTS.

IOWA CITY, IOWA:
DECEMBER, 1896.

Vol. IV. No. 1.

BULLETIN

FROM THE

LABORATORIES OF NATURAL HISTORY

OF THE

STATE UNIVERSITY OF IOWA.

PUBLISHED
BY AUTHORITY OF THE REGENTS.

IOWA CITY, IOWA:
DECEMBER, 1896.

Secretary WM. J. HADDOCK:

We take pleasure in submitting herewith Bulletin No. 1, of Volume IV, from the Laboratories of Natural History, of the State University of Iowa.

THE EDITORS.

NOTES ON PLYMOUTH HYDROIDS.

By C. C. NUTTING.

Reprinted from the Journal of the Marine Biological Association, of the United Kingdom, N. S., Vol. iv, No. 2, February, 1896.

The following notes are based upon observations made during April and the first half of May, 1895. Although the *Plumularidæ* were the special objects of study, a number of facts concerning other forms were noticed, which, together with the discussion of certain matters brought out in the special study of the *Plumularidæ*, were considered by the Director to be of sufficient interest for publication in this Journal. It will be understood that no general discussion of the hydroids at Plymouth is attempted, nor is it my purpose to give a list of the hydroid forms of that exceedingly rich field, no species being mentioned unless some new fact has been observed concerning it.

Eudendrium album, n. sp.[1]

Habitat. On stones in shallow-water near Millbay Channel. The stones are often covered with a dense growth of this hydroid, which appears to the unaided eye like white cottony tufts or downy patches. The gonophores were abundant in April.

The distinguishing features of this species are the minuteness of the colony and of the individual hydranths, both of which are less than half the height of any other Eudendrium from British waters, and the very striking white colour of the hydranths, a feature not found in any other Eudendrium in that locality. *Eudendrium album* is one of the most abundant hydroids at Plymouth during the spring, where it has heretofore been regarded as *Eudendrium capillare* Alder. It seemed, however, so different from the descriptions and figures of that species given by Alder, Hincks, and Allman, that specimens were sent to the veteran authority on hydroids —Professor Allman—who regarded it as probably new, and advised the writer to describe it as such.

---

[1] This is the species referred to by Allen, Vol. iv, No. 1, p. 49, of this Journal. A full description, with figures, will shortly be published in *Ann. and Mag. Nat. Hist.*

CLYTEA JOHNSTONI *Alder*. Medusæ of this species were produced in the aquaria in May.

OBELIA GENICULATA *Linn.* Numbers of the medusæ of this species were bred in the tanks and bottles of the Laboratory during the latter part of April. They may be readily distinguished from the medusæ of *Obelia dichotoma*, which is very abundant at Plymouth, by the fact that the former have 24 marginal tentacles, while the latter has but 16 at the time of liberation. These small medusæ are readily preserved with the tentacles well expanded by stupefying with cocaine and passing through three or four grades of alcohol.

OBELIA LONGISSIMA *Pallas?* A specimen brought to the Laboratory early in April is referred with some doubt to this species, which it closely resembled in all respects, except in the fact that the hydrothecæ were marked with regular longitudinal flutings, the ridges between the adjacent hollows terminating in blunt teeth at the margin. This beautiful ornamentation was quite constant in the hydrothecæ, and formed so striking a feature as to suggest a new species. The close agreement, however, of the specimen with Hincks' description and figures of *O. longissima*, taken together with the great delicacy of the hydrothecæ of the latter, render it probable that the form under consideration was *O. longissima*, with the delicate hydrothecæ shrunken so as to be thrown into longitudinal flutings. The gonosome was not present.

Secured in Millbay Channel from a depth of about eighteen fathoms.

CAMPANULARIA NEGLECTA *Alder*. This very minute Campanularian was found growing on the stems of *Tubularia indivisa*. There were several gonangia present, but the acrocysts were not developed. So far as I can ascertain, *C. neglecta* has not been reported from Plymouth by previous observers, probably having been overlooked on account of its small size. It is only occasionally that the bimucronate ornamentation of the margin can be made out. The stem in its manner of branching and flexuose habit resembles a miniature *C. flexuosa*.

CAMPANULARIA FLEXUOSA *Hincks*. This beautiful species was found with gonosome well developed, on May 1st. The gonangia differed from Hincks' description in being ornamented with shallow but regular annulations throughout their length. At first glance no indication of this annulation is seen, but with proper treatment of light the markings are plainly made out, and appear to be as symmetrical as those so beautifully shown in the gonangia of *Clytea Johnstoni*.

CAMPANULARIA FRAGILIS *Hincks*. Not before reported from Plymouth. The single specimen secured from the rocks near Millbay Channel was destitute of gonosome, but showed the characteristic tubular plain-rimmed hydrothecæ of the species. The hydranths have about twenty tentacles, and the proboscis is ovate in outline when the hydranth is expanded, thus differing from most of the *Campanularidæ*.

GONOTHYRÆA LOVÈNI *Allman*. This is one of the most abundant species at Plymouth. A number of specimens of the genus that were brought in from time to time during April and May differed so materially from *G. lovèni*, and agreed so closely with the descriptions of *G. hyalina* Hincks, that I regarded them as belonging to the latter species, and had so labelled them, when another batch of specimens was brought in which showed completely intergrading forms joining the typical *G. lovèni* with almost typical *G. hyalina*. There is a strong probability that these two so-called species are but varieties of one form, which should bear the name of *G. lovèni* Allman.

OPERCULARELLA LACERATA *Johnston.* Found growing on young stems of *Tubularia indivisa* from Millbay rocks, on April 26th. Other specimens were creeping over the stems of Eudendrium. This is, I believe, the first recorded occurrence of the species at Plymouth.

OPERCULARELLA HISPIDA, n. sp [1]

This species bears some resemblance to *Calycella syringa* Linn., from which it differs in having a much shorter pedicel, a not strictly tubular hydrotheca, a greater number of segments to the operculum, in the absence of the tubular extension of the operculum, and in a much thinner structure, the hydrothecæ being of glassy transparency in *O. hispida* but of a decided brownish or yellowish horn colour in *C. syringa.* The most striking feature, however, of the present species is the remarkably hispid appearance of the tentacles, which appear to be made up of series of triangular segments on account of the formidable array of large nematocysts with which they are armed. While examining the expanded tentacles with a ⅛ objective, I was so fortunate as to see these batteries of projectiles suddenly explode, sending out a perfect maze of barbed threads, which appeared to be larger and longer than those of any hydroid that I have seen, except *Nematophorus grandis* Clarke.

In the absence of the gonosome, it is impossible to say with any certainty to which genus this interesting little species belongs. The general form of the hydrotheca, the cylindrical hydranth with conical proboscis together with the convergent teeth, give a facies like that of the genus *Opercularella,* in which it is provisionally placed.

CADYCELLA SYRINGA *Linn.* Found growing abundantly on young stems of *Tubularia indivisa.* The pedicels are often much longer than one would judge from Hincks' figure. The mass of root-stalks from this species running along in approximately parallel lines on the host and giving off the peduncled hydrothecæ, affords a good idea of how the fascicled stems of hydroids may have arisen. In some of the specimens the aggregation of root-stalks would doubtless be sufficiently rigid to support themselves in an erect position after the stem to which they cling had died, and we should then have a loosely put together, fascicled stem, which a little further differentiation would convert into a typical polysiphonic hydrocaulus.

---

[1] A detailed description, with figures, will appear in the *Ann. and Mag. Nat. Hist.*

The tubular extension of the hydrothecæ reminds one of similar structures in the genus *Cryptolaria*, which contains several species further related to the one under discussion, in having the operculum composed of convergent segments.

CUSPIDELLA GRANDIS *Hincks*. In looking over my Plymouth series of hydroids after returning to America, I found specimens of this species growing over the stems of *Halecium tenellum*. A careful examination of the stems of the larger hydroids is frequently repaid by the discovery of one or more species of minute parasitic forms which escape the casual observer, and it is quite likely that a number of new species would reward the patience of any one who would devote himself for a time to a search for these forms on British coasts.

HALECIUM TENELLUM *Hincks*. A number of colonies with female gonangia were taken from a depth of 18 fathoms on April 19th. These specimens closely resemble in several points miniature colonies of *H. labrosum* Alder, especially in the shape of the gonangia and the wrinkled appearance of the stems, which, however, are monosiphonic. Indeed, one cannot wonder that Alder mistook *H. tenellum* for the young of *H. labrosum*. Out of a large number of colonies of *H. tenellum* from Plymouth, there are none over half an inch in height, and they very generally show the reduplication of the margins of the hydrophores, which Hincks mentions as a characteristic feature.

PLUMULARIA PINNATA *Linn*. This is by far the most abundant Plumularian at Plymouth, and afforded an excellent opportunity to study the morphology and reproduction of the group.

The Nematophores. There is a great deal of confusion of terms regarding these structures. The name properly applies to both the sarcodal process and the chitinous receptacle into which it retracts, although it is often used to denote either one of these structures. The terms "sarcostyle," denoting the sarcodal process, and "sarcotheca," denoting the chitinous receptacle, have now come into general use. Hincks' description of *P. pinnata* is incomplete, in that it does not notice the sarcostyles which occur without the investing sarcothecæ. One pair of these naked sarcostyles is found in the usual position of the supracalycine nematophores, and another pair is in the axil of each hydrocladium.

The structure of the nematophores has been the subject of much discussion, particularly by Hincks, Allman, Reichart, Merejkowsky, Weismann, and Jickeli. With the excellent facilities afforded by the Plymouth laboratory, and the valuable suggestions of its director, I secured a number of fortunate serial sections of the expanded sarcostyles of *P. pinnata*, and have been able to satisfy myself concerning the main points of their structure. The results of this study have corroborated the statements of Merejkowsky up to a certain point, including the following facts—

1. The greater part of the sarcostyle is composed of ectodermal cells.
2. There is a central endoderm core (or cylinder?)[1]
3. The cells on one side of this core are very large and quadrangular, while the cells on the other side and of the entire terminal portion of the sarcostyle are of ordinary size.
4. There are pseudopodia-like processes from the free surface of the sarcostyle.

On the other hand, I have been entirely unable to find any trace of the "interstitial protoplasm" described by Merejkowsky, in which he claims that the ectodermal cells are imbedded. Weismann[2] boldly suggests that this "interstitial protoplasm" is owing to an assumed necessity for free sarcode to explain the pseudopodia-like processes on the free surfaces of the sarcostyles. It seems to me that there is no logical demand for free protoplasm to explain the great extensibility of these organs. The possible tenuity of the walls of ectoderm cells can be appreciated by any one who has made a study of nematocysts, and a careful examination of the sarcostyles, both living and in serial sections, has failed to afford any evidence of free protoplasm, and this negative result is not antagonized by any physical necessity for free protoplasm in organisms which can construct endoderm cell-walls of the marvelous tenuity and extensibility of the nematocysts.

---

[1] While at Naples, the writer was able to demonstrate that this structure, in another species, has a central cavity.

[2] *Die Entstehung der Sexualzellen bei den Hydromedusen*, p. 176.

The function of the nematophores is in more doubt than their structure, and is not yet understood. It is practically certain that they are more or less degraded "persons" of the colony which have come to subserve definite functions of great service, judging from the prevalence of these structures throughout the *Plumularidæ*. So far as the species under consideration is concerned, it is safe to say that the sarcostyles are not "fighting persons" or "machopolyps," because they are not armed with any considerable number of nematocysts, the special weapons of hydroids. An examination of the living and active sarcostyles establishes the following facts—

1. The almost incredible extensibility of these organs which wind around the stem, branches, hydrothecæ, and gonangia, in a perfect maze of threads, or even flattened lobate masses.

2. In retraction, the movement is not comparable to the flowing of pseudopodia, but is effected by decided, quick, jerky retraction, giving an idea of definite outlines and cohesion. To use a crude comparison, the sarcostyle contracts much as if it was made of stretched india-rubber and not of a fluid. It is also worthy of note that there is no mechanical entanglement of the various extensions of the sarcostyles, although they appear to be hopelessly intertwined.

3. The sarcostyles are particularly active in the vicinity of mutilated or dead hydranths and gonophores, particularly the

latter, and seem to have a definite object in climbing over the sides and into the interior of hydrothecæ and gonangia. There is no evidence that they are able to repair damaged parts.

4. An examination of living sarcostyles, under a high magnification, disclosed certain cells on the distal surface which had the characteristic outlines and movements of amœboid cells, and contained foreign particles.

It would seem from the foregoing observations that the sarcostyles of *P. pinnata* are primarily neither fighting persons, nor persons concerned in the repair of mutilated or diseased parts. It is probable, on the other hand, that they do remove extraneous matter, or dead organic material from the interior of the hydrothecæ[1] and gonangia, and that they may aid in the capture and ingestion of food for the colony.

Origin of the sex-cells. This species is an excellent one for the demonstration of the cœnosarcal origin of the sex-cells in the *Plumularidæ* as first announced by Weismann.[2] The gonangia are so excessively numerous that a single series of sections may often be obtained which will show nearly all stages of this interesting process. The course of events in *P. pinnata* agrees very closely with Weismann's description of the origin of the sex-cells in *P. echinulata*, both ova and spermatoblasts, arising in the endoderm of the stem and afterwards migrating into the gonophores, ultimately appearing as ova, or sperm-masses in the matured structures. The ova break through the "stutzlamella" and are fertilized and undergo segmentation between the stutzlamella and the ectoderm. Although the ultimate division of the spermatoblasts may take place in the ectoderm, the primary divisions occur in the endoderm. I have been unable to find any cells recognisable as spermatoblasts in the ectoderm, although very satisfactory serial sections were made of the male gonophores. It may be, however, that my specimens were too near maturity to furnish conclusive evidence in this matter. In living specimens a division of sperm-cells with partially-developed flagella was observed in the ectoderm.

---

[1] E. METSCHNIKOFF, *Quart. Jour. Micr. Sci.* No. 93.

[2] See *Die Entstehung der Sexualzellen bei den Hydromedusen*, by Dr. August Weismann. The first announcement was in *Zool. Anzeig.* No. 75, 1880.

Asexual multiplication of P. pinnata. On April 23rd several colonies of this species were brought in, which were peculiar in having the ends of a number of hydrocladia greatly elongated, destitute of hydrothecæ and nematophores, and distinctly clavate at the tips. Such specimens were brought in almost daily for some time, whenever the boat went out for collecting. The first colonies found were isolated and kept under observation. They rapidly increased in length, and the terminal turgescence became more prominent. In three or four days it was noticed that these enlarged ends were forking and commencing to branch.

In about a week after the first specimens were noticed, it was found that the side of the jar in which the colonies were confined was marked with closely adhering thread-like filaments, which, on examination, proved to be the greatly produced hydrocladial extensions mentioned above, and they were still connected with the colonies from which they sprung. From these adherent extensions were growing new colonies of *P. pinnata* in various stages of development.

After a time the connection between the parent colonies and the young was severed by atrophy of the connecting hydrocladial extension, rootlets were put forth from the adherent portion or end of the original hydrocladia, and thus young and perfectly independent colonies were produced which grew rapidly during the next few weeks. Another group of colonies showing the hydrocladial extensions was so placed that the extensions could not touch the sides of the bottle in which they were kept. In this case the hydrocladia grew and forked as before, and new colonies arose from the forked ends of the hydrocladia. The parent stalks afterwards died and fell to the bottom, giving the young colonies a chance to attach themselves to the glass.

This process reminds one so forcibly of the sending out of stolons from which new shoots arise, as seen in many plants, that I have proposed the name of stoloniferous reproduction for the asexual multiplication of *P. pinnata* as above described.[1] It is the first recorded instance of the kind among the Hydroida so far as I can find, although it bears considerable resemblance to the fissiparous formation of frustules as recorded by Allman.[2]

PLUMULARIA HALECIOIDES *Alder*. This minute Plumularian was found parasitic on *Antennularia*. The gonosome was not present.

PLUMULARIA ALLENI,[3] n. sp.

Habitat. Found growing on *Antennularia ramosa*. This delicate species bears considerable general resemblance in size, form, and parasitic habit to *P. halecioides*. It differs, however, in having a non-fascicled stem, smaller hydrothecæ, more numerous nematophores, and especially in the gonangia, which are greatly unlike the annulated structure of *P. halecioides*.

AGLAOPHENIA PLUMA *Linn*. In studying the development of the corbulæ of this species, an interesting fact regarding the sarcostyles was noticed. A young corbula was under examination, the leaves or ribs of which had not yet coalesced, and the sarcostyles of one leaf were seen to stretch across and attach themselves to the next leaf in front, and remain for some time in that position. It appeared as if these sarcostyles served as temporary attachments to hold the edges of the two leaves together, while they were connected by trabiculæ of cœnosarc, which rapidly formed a stronger and permanent connection. The perisarc of the edges of the leaves seemed exceedingly thin, and in places appeared to be wanting. A contact having been established between the edges of adjacent leaves, the permanent attachment was soon formed, and the cœlomic cavities of the leaves established connections at these points. A little later, currents of water bearing granules were seen to flow in active streams from one leaf to the other. In their incipient stages it is difficult to tell the difference between sarcostyles and gonophores, and they make their appearance at about the same period in the development of the corbulæ.

---

[1] See *American Naturalist*, November, 1895.

[2] *Gymnoblastic Hydroids*, p. 152.

[3] Named in honour of the Director of the Plymouth Laboratory, an enthusiastic worker in marine zoology. Detailed description with figures will be published in *Ann. and Mag. Nat. Hist.*

Aglaophenia helleri *Marktanner-Turneretscher.*[1] This is the form collected by Mr. Allen from Eddystone Rocks, and mentioned by him on page 49, Volume iv, No. 1, of this Journal. This being the first record of *A. helleri* on British shores, the following description is given for the benefit of those who may not have access to the original—

Trophosome. Colony unbranched, attaining a height of three-quarters of an inch. Stem monosiphonic, divided by very deep nodes into short internodes, each bearing a hydrocladium springing from its anterolateral aspect. Hydrocladia alternate, closely-set, divided into internodes each bearing a hydrotheca, and partly divided by two imperfect transverse septa. Nodes very distinct. Hydrothecæ obconic, about as deep as the aperture is wide. Marginal teeth nine, unequal in size, the anterior one often being slightly incurved, and rather longer and more pointed than the others; the second and fourth teeth, counting from behind, are larger than the first and third. There is no apparent intrathecal ridge. Supracalycine nematophores rather small, stout, reaching to the level of the hydrothecal margin; the mesial nematophore springs from just below the margin of the hydrotheca, and projects straight upward and outward, its truncated end reaching to the level of the longest marginal teeth. There are two modified nematophores on each hydrocladium near its base.

Gonosome. (Description from Naples specimen.) Corbula thick and short, with the leaves or ribs more closely soldered together than in other small British species. Ribs six on each side, with a row of nematophores on their distal edges.

Habitat. Found growing on thick roots of marine plants taken from Eddystone Rocks.

Distribution. Naples and Rovigno (Marktanner-Turneretscher), and Plymouth, England.

---

[1] *Die Hydroiden des K. K. Naturhistorischen Hofmuseums*, Vienna, 1890, p. 271, plate vii.

THE MOLLUSKS AND BRACHIOPODS OF THE BAHAMA EXPEDITION OF THE STATE UNIVERSITY OF IOWA.

BY WILLIAM HEALEY DALL, A. M.,
HONORARY CURATOR DEPT. OF MOLLUSKS U. S. NAT. MUS. PALEONTOLOGIST TO THE U. S. GEOLOGICAL SURVEY.

AT the request of Prof. Nutting I undertook to examine and name the Mollusks collected by the Bahama expedition. These proved to be quite interesting. The shallow water fauna of the Bahamas is pretty thoroughly known, since for more than two centuries these islands have been noted for their shells, which have formed a more or less constant article of commerce. No monograph covers the fauna, and the most complete list yet made (in which, however, synonymy is not attempted) is included in my "List of Marine Mollusca from American localities between Cape Hatteras and Cape Roque, including the Bermudas,"[1] which forms an index to the chief sources of information in the literature; though doubtless many species described without locality or with wrong localities, or in publications not nominally relating to this region, should be added to those therein enumerated.

The original collections from the Strait of Florida and the Pourtalès Plateau, obtained by the Coast Survey expeditions of 1864–7, were sent to Chicago, where Dr. Wm. Stimpson was engaged in preparing a report upon them when the great fire of 1871 destroyed his manuscripts and the collections upon which they were based, including the unique *Haliotis*, *Bothrocorbula* and many other gems of the sea which have not yet been obtained by any subsequent collector. In my reports on the Mollusca of the Blake expedition[1] a large number of species from the Antillean region were described and illustrated, while others derived from the dredgings of the United States Fish Commission Steamer Albatross in the Gulf of Mexico, Florida Strait and the southeastern continental plateau of the United States. were described in the Proceedings of the United States National Museum.[2]

---

[1] Bull. U. S. Geol. Survey, No. 24, Washington, the Survey, 1885, 8° pp. 336.

The above are the principal sources of the more modern information in regard to the marine Mollusks of this region. Many of the Blake species were described from single specimens and the value and interest of the collections of the University Bahama expedition arise chiefly from the fact that quite a number of these unique forms reappear in the material obtained from the Pourtalès Plateau. The total amount of the material dredged there by the expedition was not large, but every specimen is precious. Among the shells, had the collection been larger, a proportion of new forms might have been expected; but, as it was, none occurred. Curiously enough in comparatively shallow water near the Florida Keys, a fine new species of *Murex* was obtained, to which I have attached the name of Prof. C. C. Nutting the director of the expedition; and on Water Cay, Salt Cay Bank, near the northern end of the Bahamas group, was obtained a form of *Cerion* which appears to be distinct from any yet described. Descriptions of these species and a list of all the species obtained, with localities, is appended.

MUREX NUTTINGI n. s.

Plate I.—Fig. I.

Shell white with a pale straw-colored epidermis and eight whorls exclusive of the (lost) nucleus; suture deep, whorls rounded (the last) crossed by eight varices, each bearing a rather long grooved spine at the shoulder and anteriorly about six smaller and less conspicuous spinules, each of which corresponds to a more or less distinct revolving thread; at the shoulder and behind it there is no revolving sculpture or only faint traces of it; the apical three or four whorls show angular points, rather than spines, which are partly the result of wear; canal rather long, shorter than the spire, with a wreath midway of long recurved spines, each corresponding to a varix; the siphonal fasciole imbricated by the canal-ends of successive resting-stages; pillar white, moderately callous; canal open; outer lip modified by the sculpture, not lirate; operculum pale-brown, kite-shaped, the nucleus at the acute end which is nearly straight; height of shell 40, major diameter exclusive of spines 21 mm.

---

[1] Bull. Mus. Comp. Zool. VI, No. 3, Feb. 1880; IX, No. 2, July–Dec. 1881, and XII, No. 6, Sep. 1886.

[2] Especially No. 773, vol. XII, pp. 219–362, pl. V–XIV, 1889. See also Bull. U. S. Nat. Mus. No. 37, Preliminary Catalogue of the Shell-bearing Marine Mollusks and Brachiopods of the southeastern coast of the United States, 8° 221 pp. 74 plates, 1889.

Habitat, station 41 in 15 fathoms, eight miles east of Sand Key Florida.

Types in the University and National Museums.

This fine species is very distinct, its nearest relative being *M. interserratus* Sby., which is a much smaller, proportionately less elevated species of a red-brown color with one less varix to the whorl. Both species belong to the same section of the genus. *M. interserratus* has been obtained from Montserrat, so both may be regarded as belonging to the Antillean fauna. *M. pazi* Crosse, for which the sectional name *Paziella* has been proposed, is probably only a delicate deep-water offshoot from the same stock.

M. interserratus has been erroneously referred to the genus *Muricidea* Swainson (or *Muricopsis* B. D. and D.) by F. C. Baker (Proc. Rochester Academy of Sciences, vol. 1, p. 172, 1891). From *Muricidea* these species are distinguished by the basal constriction of the last whorl by which the canal is sharply differentiated, by the edentulous peristome and single prominent wreath of spines about the middle of the canal. As a matter of fact most of the named groups of Murices are so closely connected by intermediate species that sharp lines of differentiation can not be drawn, and the numerous sectional names which have been proposed are not especially useful.

CERION (MAYNARDIA) NITELOIDES n. s.

Plate I.—Fig. 2.

Shell compact solid, grayish white, with a livid brownish lining, ten whorls of which two and and a half are nepionic and smooth, the remainder polished and for the most part faintly sculptured with little raised transverse lines, often obsolete; on the last half of the last whorl these lines are coarser, irregular and more prominent; the aperture is rounded except where the peristome crosses the body, with a slightly bevelled reflected edge; the parietal tooth is nearly central, short and low, the pillar-tooth also low, is situated about the middle of the pillar and makes a little less than a complete turn around the axis of the shell. Height of the shell 28; maximum diameter 12 mm.

Habitat. Water Cay, Salt Cay Bank on the north side of Cuba near the western end of the Bahama banks.

Types in the University and National Museums.

This species externally much resembles *Cerion* (*Maynardia*) *nitela* Maynard, which is a species native to the west end of Little Cayman island in the Caribbean Sea on the south side of Cuba. As the species of *Cerion* are very limited in their distribution the wide separation of the two localities raises a suspicion of distinctness, notwithstanding their superficial likeness, and this suspicion is measurably confirmed by the following differences: *C. nitela* has a larger axis and a considerably larger and perforate umbilicus; its parietal tooth is more elevated and less elongated, the pillar tooth slightly more elevated, and its inward prolongation decidedly more feeble, lastly its aperture is narrower, more horse-shoe shaped and less rotund than in *C. niteloides*. The apex is decidedly more pointed in the specimens of *C. nitela* before me as well as in Maynard's figures, but this character is variable in some of the species.

It may be noted here that the use of the shells by hermit crabs tends to wear away the pillar and denticulations, so that persons working over these shells should make sure, when estimating their characters, that the shell was tenanted by its architect when collected, otherwise blunders are pretty sure to be made.

The two species following have recently been received by the National Museum and belong to the same general fauna as the collections of the Bahama expedition. I have thought that the paper would gain in interest by including descriptions of them.

LIOTIA CENTRIFUGA n. s.

Plate 1.—Fig. 3.

Shell small, solid, elevated, with four whorls; nucleus smooth, flat-topped, rapidly taking on coarse imbricated spiral sculpture comprising between the sutures five ridges, the third being at the shoulder with two in front and two behind it; all are crossed by fine imbricating lamellæ, visible under magnification, and by obscure radial swellings which slightly undulate the posterior pair of spirals, while the third develops subtriangular radiating projecting points (eleven on the last whorl); the anterior spirals on the periphery of the last whorl are three and three on the rounded base the last of which marginates the narrow barely perforate umbilicus; all these spirals are nodulous or serially subimbricated but only the one at the shoulder shows projecting angles; the aperture is circular, entire, smooth inside, its margin modified by the external sculpture; height of the shell 3.5, diameter 3.5 mm.

Habitat. United States Fish Commission Station 2,328, in 203 fathoms off Havana, 1885. United States National Museum 107,419.

This neat little species needs no special comparisons, being smaller than any of those allied to it from this region and with distinctive sculpture.

CARDITELLA SMITHII n. s.

Plate 1.—Fig. 4.

Shell minute, ferruginous brown to pale straw-color, bleaching white; inflated, with prominent subcentral beaks, evenly arched basal margin, and straight slopes diverging about 90° from the beaks; sculpture of 10–12 rounded nodulous radiating riblets with narrower inter-spaces crossed by rather prominent incremental lines; internal basal margins strongly crenulated by the sculpture; hinge line narrow and feeble. ligament largely immersed; resilium small subumbonal. Height of shell 2.0; length 2.0; diameter 1.0 mm.

Habitat: Bermuda, received from Prof. R. P. Whitfield. collected by Miss Peniston on the beach. Types, American Museum of Natural History, Central Park, New York City, and United States National Museum, No. 107,365.

The occurrence of this little shell at Bermuda is very interesting as the genus was originally described from Port Rosario, Patagonia, in two to thirty fathoms. other species being known from the west coast of South America, Tristan d'Acunha, the Cape of Good Hope, and Australasia. The present species, is, I believe, the first described from the northern hemisphere and is respectfully dedicated to Mr. Edgar A. Smith, Assistant to the British Museum, the author of the genus.

From the Patagonian type, *C. pallida* Smith, (P. L. S. 1881, p. 43, pl. v. figs. 9, a–b), this differs by its more triangular shape, fewer ribs, and smaller size. All the other species are even less similar. *C. smithii* looks very much like a miniature edition of *Cardita* (*Pleuromeris*) *tridentata* Say, but a careful scrutiny of numerous specimens of the latter species gives no evidence of the existence of any separate resilium, the ligament and resilium being joined in the ordinary way as a single organ, rather deeply sunken and allowing only a narrow lineal portion to be visible externally between the edges of the closed valves. The same is true of *Cardita dominguensis* Orb. and the curious *Cardita radians* Conrad (+ *flabella* Conr. 1846, non Reeve, 1843 + *Venericardia obliqua* Bush) and it seems in spite of their marked differences of form as if there was no ground for referring either of the three to any group which will not receive the others.

LIST OF SPECIES.

BRACHIOPODA.

TEREBRATULA CUBENSIS *Pourt.* Sta. 37, Off Key West, 90 fath. Sta. 51, 52, 56, 63, 64, Pourtalès Plateau, off American Shoal, 85 to 110 fath.

TEREBRATULINA CAILLETI *Crosse.* Sta. 56, Pourtalès Plateau, 24° 16′ N. Lat., 81° 22′ W. Long., about 200 fath.

DALLINA FLORIDANA *Pourt.* Sta. 35, 38, off Key West, 90–125 fath: Sta. 56, Pourtalès Plateau, 24° 16′ N. Lat., 81° 22′ W. Long., about 200 fath.

PELECYPODA.

PECTEN NUCLEUS *Born?* Bahama Bank.
Very young specimen.

PECTEN ORNATUS *Lam.* Tortugas.

LIMA SQUAMOSA *Lam.* Tortugas: Sta. 56, Pourtalès Plateau, 24° 16′ N. Lat., 81° 22′ W. Long., about 200 fathoms. These are the adult of the young form called *antillarum* by D'Orbigny.

LIMA SCABRA *Born.* Bahia Honda, Cuba?

AVICULA RADIATA *Leach.* Bahia Honda, Cuba: Spanish Wells and Harbor Island, Bahamas: Tortugas.

AVICULA ATLANTICA *Lam.* Tortugas.

AVICULA CROCATA *Sw.* Tortugas.

PERNA OBLIQUA *Lam.* Tortugas.

PERNA EPHIPPIUM *Lam.* Bahia Honda, Cuba.

PINNA PERNULA *Chem.* (=CARNEA *Gmel.*), Tortugas.

MYTILUS DOMINGUENSIS *Lam.* (=EXUSTUS *Linn.*), Egg Island, Bahamas; Bahia Honda, Cuba.

MYTILUS LAVALLEANUS *Orb.* Bahia Honda, Cuba.

MODIOLA TULIPA *Linn.* Bahia Honda, Cuba.

LITHOPHAGUS ANTILLARUM *Philippi.* Tortugas.

LITHOPHAGUS BISULCATUS *Orb.* Bahia Honda, Cuba.

ARCA NOÆ *Linn.* Bahama Bank; Bahia Honda, Cuba; Harbor Island, Bahamas; Sta. 26, off Key West, 60 fath. The variety *occidentalis* Phil. occurred at Harbor Island, as well as the typical form.

ARCA IMBRICATA *Brug.* Bahia Honda, Cuba.

ARCA UMBONATA *Lam.* Tortugas.

ARCA (BARBATIA) BARBATA *Linn.* Tortugas.

ARCA (ANADARA) JAMAICENSIS *Gmel.* Great Bahama Bank; Bahia Honda, Cuba; Spanish Wells and Harbor Island, Bahamas.

PECTUNCULUS UNDATUS *Linn.* Bahia Honda, Cuba.

PECTUNCULUS sp. (*young*). Bahama Bank.

ASTARTE NANA *Jeffreys.* Great Bahama Bank.

GOULDIA CERINA *C. B. A.* Great Bahama Bank.

Type of the genus which is closely related to *Circe.* The small forms usually referred to *Gouldia* belong to *Pseuderiphyla* of the *Crassatellidæ*=*Crassinella* Guppy *non* Conrad *nec* Bayle.

LUCINA PENNSYLVANICA *Linn.* Bahia Honda, Cuba.

LUCINA TIGRINA *Linn.* Bahia Honda, Cuba.

CHAMA (ECHINOCHAMA) ARCINELLA *Linn.* Sta. 66 and 67, off Key West, 6 fathoms.

CHAMA LACTUCA *Dall.* Sta. 56, Pourtalès Plateau, 24° 16′ N. Lat., 81° 22′ W. Long., 200 fathoms. *Chama nicolloni* Dautzenberg from 65 fathoms off the coast of France near Croisic, growing on *Dendrophyllia cornigera*, is suspiciously close to this species.

CARDIUM MURICATUM *Linn.* Bahia Honda, Cuba.

CARDIUM MEDIUM *Linn.* (*young valve*). Sta. 44, off Key West, 5¼ fath.

CARDIUM SERRATUM *Linn.* Sta. 26, off Key West, 60 fath.: Harbor Island and Spanish Wells, Bahamas, shallow water.

VENUS (CHIONE) CANCELLATA *Linn.* Bahia Honda, Cuba; Spanish Wells, Bahamas; Tortugas; Great Bahama Bank; Sta. 44, off Key West, 5¼ fath.

VENUS (CHIONE) GRANULATA *Gmel.* Bahia Honda, Cuba.

VENUS sp. (*young*). Sta. 44, off Key West, 5¼ fath.

CYTHEREA ALBIDA *Lam.* (*young*). Sta. 56, Pourtalès Plateau, 24° 16′ N. Lat., 81° 22′ W. Long., 200 fathoms.

PETRICOLA ROBUSTA *Sby.* Bahia Honda, Cuba. Type of the genus *Choristodon* Jonas.

TAGELUS DIVISUS *Spengler.* Sta. 44, off Key West, 5¼ fath.

ASAPHIS DEFLORATA *Linn.* Bahia Honda, Cuba.

TELLINA sp. Sta. 44, off Key West, 5¼ fath. This and the following species not identifiable.

MACOMA sp. Sta. 44, off Key West, 54 fath.

CUMINGIA TELLINOIDES *Con.* Great Bahama Bank.

SEMELE RETICULATA *Linn.* Bahia Honda, Cuba.

SCAPHOPODA.

DENTALIUM ANTILLARUM *Orb.* Sta. 56, Pourtalès Plateau, 24° 16′ N. Lat., 81° 22′ W. Long., 200 fath.

PTEROPODA.

CAVOLINIA TRIDENTATA *Forsk.* Sta. 64, off American Shoal, 110 fath.

CAVOLINIA UNCINATA *Rang.* Sta. 64 off American Shoal, 110 fath.

GASTROPODA.

HEMITROCHUS CARIBÆA *Weinland.* Spanish Wells and Eleuthera, Bahamas.

Pleurodonte auricoma *Fer.* Havana.

Cerion (Maynardia) chrysalis *Fer.* Fort San Diego, Havana.

Cerion (Maynardia) niteloides *Dall.* Pl. 1, Fig. 2, Water Cay, Bahamas.

See description for details.

Cerion (Maynardia) mumiola *Pfr.* Tortugas.

This species was described from Cuba and the occurrence on Tortugas is probably the result of transportation by sea drift. If living at Tortugas it would add a new species to the fauna of the United States.

Cerion (Maynardia) coryi *Mayn.* Egg Island, Bahamas.

Bulla striata *Brug.* Spanish Wells, Bahamas; Bahia Honda, Cuba.

Scyllæa pelagica *Linn.* 31° 31′ N. Lat., 75° 11′ W. Long.

Melampus lineatus *Say.* Egg Island, Bahamas.

Melampus caffeus *Linn.* Bahia Honda, Cuba.

Terebra dislocata *Say.* Great Bahama Bank.

Conus flavescens *Gray.* Sta. 25, off Key West, 60 fath.; Sta. 56, Pourtalès Plateau, 24° 16′ N. Lat., 81° 22′ W. Long., 200 fath.

Conus verrucosus *Hwass.* Great Bahama Bank.

Conus mus *Hwass.* Loggerhead Key, Tortugas.

Pleurotoma albida *Perry.* Sta. 26, off Key West, 60 fath.

Drillia acestra *Dall.* Sta. 56, Pourtalès Plateau, 24° 16′ N. Lat., 81° 22′ W. Long., 200 fath.

The type specimens were previously unique.

Drillia lissotropis *Dall.* Sta. 56, Pourtalès Plateau, 24° 16′ N. Lat., 81° 22′ W. Long., 200 fath.

These are the first specimens obtained since the original types.

DAPHNELLA *sp.* Sta. 56, Pourtalès Plateau, 24° 16′ N. Lat., 81° 22′ W. Long., about 200 fathoms.

Too imperfect for identification.

GLYPHOSTOMA GABBII *Dall.* Sta. 56, Pourtalès Plateau, 24° 16′ N. Lat., 81° 22′ W. Long., 200 fath.

The original types have hitherto been unique.

MARGINELLA GUTTATA *Dillw.* Sta. 56, Pourtalès Plateau, 24° 16′ N. Lat., 81° 22′ W. Long., 200 fath.

MARGINELLA AMABILIS *Redfield.* Sta. 63, off American Shoal 85 to 95 fath.

A rare and little known species.

MARGINELLA BELLA *Conrad.* Sta. 64, off American Shoal, about 110 fath.

Hardly known in collections.

MARGINELLA SUCCINEA *Con?* Sta. 57, Pourtalès Plateau, 24° 16′ N. Lat., 81° 22′ W. Long., 200 fath.

MARGINELLA AVENA *Valenciennes.* Sta. 64, off American Shoal, 110 fath.; Sta. 56, Pourtalès Plateau 24° 16′ N. Lat., 81° 22′ W. Long., 200 fath.

MARGINELLA *sp.* Sta. 56, Pourtalès Plateau, 24° 16′ N. Lat., 81° 22′ W. Long., 200 fath.

Too poor to identify.

TURBINELLA SCOLYMUS *Gm.* Harbor Island, Bahamas.

VASUM MURICATUM *Born.* (Label lost.)

CONOMITRA BLAKEANA *Dall.* Sta. 56, Pourtalès Plateau, 24° 16′ N. Lat., 81° 22′ W. Long., 200 fath.

Only known hitherto from the types.

FASCIOLARIA TULIPA *Linn.* Bahia Honda, Cuba; Dry Tortugas, Florida; Egg Island, Bahamas; Great Bahama Bank.

FULGUR PERVERSUS *Linn.* (Locality lost.)

LEUCOZONIA CINGULIFERA *Lam.* Tortugas.

LEUCOZONIA LEUCOZONALIS *Lam.* Tortugas.

FUSUS EUCOSMIUS *Dall.* Sta. 26, off Key West, 60 fath.

Only known hitherto from the original types.

TRITONIDEA TINCTA *Conrad.* Tortugas; Great Bahama Bank.

NASSA AMBIGUA *Mont.* Tortugas.

COLUMBELLA MERCATORIA *Linn.* Great Bahama Bank; Tortugas.

COLUMBELLA RUSTICOIDES *Heilprin.* Great Bahama Bank; Tortugas.

This is the *rustica* of authors, not Lamarck. The original *rustica* is an Old-world species.

MUREX BEAUI *F. & B.* Sta. 42, off Sand Key, 15 fath.

Rare and interesting.

MUREX CABRITII *Bern.* Sta. 44, off Key West, 5¼ fath.

Hardly known in collections.

MUREX FLORIFER *Reeve.* Bahia Honda, Cuba.

This is probably an exuberant form of *M. rufus.*

MUREX RUFUS *Lam.* Bahia Honda, Cuba.

This is the Antillean form frequently listed as *M. adustus*, but wholly distinct from the true *adustus.*

MUREX POMUM *Gmel.* Bahia Honda, Cuba; Tortugas; Spanish Wells, Bahamas.

MUREX TRISTICHUS *Dall.* Sta. 60, Pourtalès Plateau, 24°, 15′ N. Lat., 81° 20′ W. Long., 130 fath.

The only specimen known except the original types.

MUREX NUTTINGI *Dall.* Pl. 1, Fig. 1. Sta. 41, off Sand Key, 15 fath.

See description for details.

PURPURA PATULA *Linn.* Harbor Island, Bahamas.

PURPURA DELTOIDEA *Lam.* Egg Island, Bahamas; Loggerhead Key, Tortugas.

PURPURA BICOSTALIS *Lam.* (=*hæmastoma* var.) Bahia Honda, Cuba.

PURPURA UNDATA *Lam.* (=*hæmastoma* var.) Bahia Honda, Cuba.

CORALLIOPHILA DEBURGHIÆ *Reeve*, var. Off Key West. A rare and remarkable shell.

TRITONIUM TRITONIS *Linn.*, var. (loc. lost.)

TRITONIUM TUBEROSUM *Lam.* Harbor Island, Bahamas.

TRITONIUM PILEARE *Lam.* Bahia Honda, Cuba.

TRITONIUM GRACILE *Reeve.* Egg Island, Bahamas.

SIMNIA UNIPLICATA *Sowb.*

OVULUM GIBBOSUM *Linn.* Bird Key, Tortugas.

CYPRÆA EXANTHEMA *Linn.* Tortugas.

CYPRÆA SPURCA *Linn.* Sta. 56, Pourtalès Plateau, 24° 16′ N. Lat., 81 °22′ W. Long., 200 fathoms. Dead.

TRIVIA PEDICULUS *Linn.* Tortugas; Sta. 26, off Key West, 60 fath.

TRIVIA QUADRIPUNCTATA *Gray.* Tortugas; Great Bahama Bank.

TRIVIA GLOBOSA *Gray.* Sta. 56, Pourtalès Plateau, 24° 16′ N. Lat., 81° 22′ W. Long., 200 fath.

ERATO MAUGERIÆ *Gray.* Sta. 56, Pourtalès Plateau, 24° 16′ N. Lat., 81° 22′ W. Long., 200 fath.

ATLANTA PERONII *Lesueur.* Sta. 63, off American Shoal, 85 to 95 fath.

STROMBUS GIGAS *Linn.* Bahamas generally; Tortugas.

STROMBUS BITUBERCULATUS *Lam.* Bahamas.

CERITHIUM FLORIDANUM *Mörch.* Tortugas; Bahia Honda, Cuba.

CERITHIUM ALGICOLA *C.B. Ads.* Tortugas; Great Bahama Bank; Bahia Honda, Cuba; Spanish Wells, Bahamas.

CERITHIUM LITTERATUM *Born.* Harbor Island, Egg Island, and Spanish Wells, Bahamas.

CERITHIUM SEMIFERRUGINEUM *Lam.* Locality lost. Common in the Antilles and southeast United States coast.

SISTRUM NODULOSUM *C. B. A.* Egg Island, Bahamas; Tortugas.

CERITHIUM NIGRESCENS *Menke.* Tortugas; Egg Island, Bahamas.

MODULUS "LENTICULARIS *Ch.*" (M. MODULUS *Linn.*) Tortugas; Spanish Wells, Bahamas; Bahia Honda, Cuba.

SILIQUARIA MODESTA *Dall.* Sta. 56, Pourtalès Plateau, 24° 16′ N. Lat., 81° 22′ W. Long., 200 fath.
The first reported since the original types.

VERMICULARIA SPIRATA *Phil.* Harbor Island, Bahamas.

TURRITELLA EXOLETA *Linn.* Sta. 26, off Key West, 60 fathoms. Young specimens of what seems to be this species were taken at Sta. 56, in 200 fath.

TURRITELLA ACROPORA *Dall.* (Locality lost.)
Common south of Hatteras and in the Antilles.

LITORINA ZICZAC *Dillw.* Tortugas; Egg Island, Harbor Island, and Spanish Wells, Bahamas.

LITORINA SCABRA var. LINEATA *Gmel.* Bahia Honda, Cuba.

LITORINA MESPILUM *Menke.* Egg Island, Bahamas.

TECTARIUS MURICATUS *Linn.* Bahia Honda, Cuba; Egg Island, Harbor Island, Spanish Wells and Eleuthera, Bahamas.

ECHINELLA NODULOSA *Gmel.* Egg Island, Harbor Island, Spanish Wells and Eleuthera, Bahamas.

CREPIDULA FORNICATA *Linn.* Sta. 44, off Key West, 5¼ fath.

CREPIDULA ACULEATA *Gmel.* Great Bahama Bank.

XENOPHORA CONCHYLIOPHORA *Born.* Great Bahama Bank.

NATICA LIVIDA *Pfr.* Bahia Honda, Cuba.

NATICA CANRENA *Lam.* (?) Tortugas.
Specimen in poor condition.

POLYNICES LACTEA *Guild.* (Locality lost.)
Common in the Antillean and south Florida region.

ACMÆA CANDEANA *Orb.* Egg Island, Bahamas.

ACMÆA PUNCTULATA *Gmel.* Tortugas.

ACMÆA MELANOLEUCA *Gmel.* Tortugas; Harbor Island, Bahamas.

ASTRALIUM LONGISPINUM *Lam.* Harbor Island, Bahamas; Great Bahama Bank; Tortugas; Bahia Honda, Cuba.

ASTRALIUM AMERICANUM *Gmel.* Tortugas.

LEPTOTHYRA INDUTA *Watson*, var. ALBIDA *Dall.* Sta. 65, off American Shoal, 115 fath.
First specimens since the types were obtained.

OMPHALIUS FASCIATUS *Born.* Tortugas; Great Bahama Bank.

OMPHALIUS INDUSII *Chem.* Loggerhead Key, Tortugas.

LIVONA PICA *Gmel.* Egg Island, Bahamas.

CALLIOSTOMA JUJUBINUM *Gmel.* Tortugas; the var. RAWSONI *Dall.* occurred in the same locality.

CALLIOSTOMA ASPERRIMUM *Dall.* Sta. 56, Pourtalès Plateau, 24° 16′ N. Lat., 81° 22′ W. Long., 200 fath.
Rare, hardly known in collections.

EUCHELUS EUCASTA *Dall.* Sta. 56, Pourtalès Plateau, 24° 16′ N. Lat., 81° 22′ W. Long., 200 fath.
Only the types heretofore known.

LIOTIA BRIAREUS var. PERFORATA *Dall.* Sta. 56, Pourtalès Plateau, 24° 16′ N. Lat., 81° 22′ W. Long., 200 fath.
Known only from the types hitherto.

LIOTIA VARIABILIS *Dall.* Sta. 56, Pourtalès Plateau, 24° 16′ N. Lat., 81° 22′ W. Long., 200 fath.
Only known from the original types hitherto.

NERITA PELORONTA *Linn.* Egg Island, Bahamas; Tortugas.

NERITA TESSELLATA *Gmel.* Egg Island, Spanish Wells, Harbor Island, Bahamas; Tortugas.

NERITA PRÆCOGNITA *C. B. Ad.* Bahia Honda, Cuba.

NERITA VERSICOLOR *Lam.* Spanish Wells, Egg Island, Harbor Island, Bahamas; Tortugas.

EMARGINULA COMPRESSA *Cantr.* Sta. 56, Pourtalès Plateau, 24° 16′ N. Lat., 81° 22′ W. Long., 200 fath.
Found also in the Mediterranean. Rare in the Antilles.

FISSURELLA BARBADENSIS *Gmel.* Egg Island, Bahamas.

FISSURELLA DYSONI *Reeve.* Sta. 56, Pourtalès Plateau 24° 16′ N. Lat., 81° 22′ W. Long., 200 fath.

FISSURIDEA ALTERNATA *Say.* Bahia Honda, Cuba.

FISSURIDEA LISTERI *Orb.* Tortugas.

FISSURIDEA FLUVIANA *Dall.* Sta. 56, Pourtalès Plateau, 24° 16′ N. Lat., 81° 22′ W. Long., 200 fath.
Heretofore known only from the types.

CHITON MARMORATUS *Gmel.* Harbor Island, Bahamas; Egg Island.

ACANTHOPLEURA PICEA *Gmel.* Harbor Island, Bahamas.

CEPHALOPODA.

ARGONAUTA ARGO *Linn.*, var. AMERICANA *Dall.* Sta. 41, off Sand Key, 15 fath.

SPIRULA AUSTRALIS (*Lam.*) *Pelseneer.* Spanish Wells and Eleuthera, Bahamas.

See Science, New Ser., III, No. 59, p. 243, Feb. 14, 1896, for notes on this species.

OCTOPUS ANTILLARUM *Orb.?* Tortugas.

This agrees fairly well with Orbigny's figures, but, in the absence of a revision of the Antillean Cephalopods it is impossible to be confident as to the accuracy of identification of species from that region.

NOTES ON THE HYMENOPTERA.

COLLECTED BY THE BAHAMA EXPEDITION FROM THE STATE UNIVERSITY OF IOWA.

BY WILLIAM H. ASHMEAD.

VERY little is known of the Hymenopterous fauna, of the Bahamas, and the following list of Hymenoptera, most of which were collected by Mr. H. F. Wickham on a visit to these Islands in 1893, will be of interest and value to those interested in the distribution of these insects.

Mr. Wickham made no special effort to collect Hymenoptera, his specialty being Coleoptera and his collecting must represent therefore, but a small fraction of the fauna.

FAMILY APIDÆ.

1. CŒLIOXYS sp.

One ♂ specimen, Egg Island. This is possibly one of the numerous species described from South America. It is parasitic or inquilinous in the nest of the leaf-cutting bees (*Megachile*). I have seen no large collection of these bees from the West Indies and South America and no effort has been made to identify the single specimen taken.

2. NOMIA WICKHAMII sp. n.

♂ Length, 12 mm. Black; face, cheeks, superior margin of collar, tubercles, metapleura, legs and sides of abdominal segments clothed with a cinereous or whitish pubescence; metascutellum with a hoary pubescence; tongue at tip piceous; palpi ferruginous; flagellum beneath dull ferruginous. The dilated posterior tibiæ and the broadly dilated apical margin, which is produced into a tooth within, yellow; the apical margins of the second, third, fourth and fifth segments banded with greenish-yellow, the band on the fourth segment not however, extending to the lateral margins. Genitalia ferruginous, the claspers very large, angulated at apex outwardly and then strongly curving inwardly and produced into a curved prong within. Apical dorsal segments medially emarginated and fringed with black and white hairs. Ventral segments two and three, yellowish at apex, the third grooved indistinctly, medially, the fourth with a deep median channel, the fifth carinated. Wings dusky hyaline, broadly fuliginous at apex; the stigma ferruginous, the veins fuscous. Head transverse, scarcely as wide as the thorax, the frons closely punctate; clypeus smooth, slightly arcuated at apex; mandibles black, with a longitudinal groove along the inner margin; thorax and scutellum with rather coarse, rounded punctures, more confluent anteriorly, but separated on the disk; metathorax closely punctate. Last four joints of anterior tarsi and the last joint of middle and hind tarsi, yellow. Abdomen twice as long as head and thorax united, the first segment rather coarsely punctate, but smooth and shining at the apical margin, and clothed with sparse white hairs; the following segments, except at margins, finely, closely punctate, the surface of the bands being smooth, polished, impunctate.

Described from 2 ♂ specimens collected at Eleuthera, Bahamas.

3. AGAPOSTEMON FEMORALIS *Guér.*

One ♂ specimen from Eleuthera.

4. HALICTUS ALBITARSATUS sp. n.

♂ length 3 to 3.5 mm. Submetallic black; face below antennæ bronzed green; scutellum and postscutellum with a brassy tinge; tarsi yellowish-white; flagellum beneath from second joint, brown.

Head transverse finely, closely punctate, less closely punctate on the face while on the clypeus the punctures are separated. The clypeus is slightly produced and truncate anteriorly; mentum transversely narrowed almost entirely covered by the clypeus, smooth, impunctate; mandibles rufous, blackish towards base; ocelli white; antennæ 13-jointed, the first flagellar joint quadrate, the second 1½ times longer. Thorax slightly purplish anteriorly, finely punctate, the scutellum with some sparse punctures and an impunctate space at the middle; mesopleura rather closely punctate; metathorax above smooth, impunctate, except at extreme base where there are some raised radiating lines but no enclosure; the sides are delicately shagreened, while the posterior face has a deep median incision followed by a carina below. Wings subhyaline, the stigma and veins dark brown; the first submarginal cell is about as long as the second and third united; the first recurrent nervure joins the second submarginal cell near its apex while the second recurrent nervure joins the third submarginal cell a little beyond its middle. Abdomen oblong-oval smooth, impunctate, the first segment with a deep emargination at base above, the second, third and fourth segments along their sutures at base narrowly impressed, the extreme apical margins of second, third, fourth and fifth segments narrowly testaceous.

♀. Length 4.5 mm. Differs from ♂ only in its larger size, the face below the antennæ being sparsely covered with whitish hairs, the clypeus fimbriate with golden hair; the antennæ 12-jointed, the second and third flagellar joints equal, a little wider than long, the first being a little longer than wide; the tibiæ and tarsi, as well as the terminal abdominal segment are covered with yellowish and whitish hairs; while the abdomen is larger, more hairy, the apical margins of the ventral segments being fimbriate with long sparse hair.

Described from ♂ and ♀ specimens, taken at Bahia Honda, Cuba, June 1.

FAMILY BEMBICIDÆ.

5. MONEDULA SIGNATA *Linn.*

One ♀ specimen from Eleuthera. A species common in South America and Cuba.

6. STIZUS HOGARDII *Latr.*

One ♀ from Eleuthera. Mr. Wickham also took a large specimen of this species at Key West, Florida. It is the first notice of its occurrence in the United States.

FAMILY SPHEGIDÆ.

7. SPHEX FULVIHIRTA *Guêr.*

Two specimens, 1 ♂ from Egg Island, 1 ♀ from Spanish Wells.

8. PELOPÆUS FASCIATUS *Lep.*

Two specimens, 1 ♂ Eleuthera, 1 ♀ Egg Island.

FAMILY POMPILIDÆ.

9. SALIUS (PRIONOCNEMIS) FLAVIPENNIS *Smith.*

One ♀ from Bahia Honda, Cuba.

FAMILY VESPIDÆ.

10. POLISTES CUBENSIS *St. Farg.*

One ♀ from Egg Island, May 13.

11. POLISTES AMERICANUS *Fabr.*

One ♂ from Eleuthera, 1 ♀ from Harbor Island, July 8.

12. POLISTES MINOR *Beauv.*

Two ♀ specimens from Eleuthera, July 15.

13. POLYBIA CUBENSIS *Sauss.*

One ♀ from Eleuthera.

FAMILY EUMENIDÆ.

14. ZETHUS AZTECUS *Sauss.*

One ♀ from Eleuthera, evidently a variety of this species with the legs, except the coxæ, entirely rufous.

15. ODYNERUS TIBIALIS *Sauss.*

One ♀ from Eleuthera, July 9.

FAMILY SCOLIIDÆ.

16. MYZINE NITIDA *Smith.*

One small ♀ from Harbor Isl. July 8.

17. ELIS TRIFASCIATUS *Fabr.*

Two ♂ specimens from Eleuthera, July 9.

FAMILY MUTILLIDÆ.

18. SPHÆROPHTHALMA FERRUGATA *Fabr.*

One ♀ specimen.

FAMILY BRACONIDÆ.

19. IPHIAULAX (BRACON) PLICATUS *Cr.*

One ♀ specimen from Eleuthera.

20. SPATHIUS ELEUTHERÆ, sp. n.

♀. Length 2.5 mm; ovipositor as long as the abdomen. Fuscous; basal four joints of antennæ and the legs including the coxæ pale yellowish; wings subhyaline, the anterior pair with whitish transverse band from the stigma; stigma and nervures brown.

Head quadrate, the face, except the median ridge wrinkled; frons rather coarsely transversely striated, the occiput more feebly striated; mesonotum trilobed, rugulose; metanotum distinctly areolated; petiole long, striated, the body of abdomen smooth, polished, with the sutures between the segments pale.

Described from 1 ♀ specimen, taken July 9, from Eleuthera.

FAMILY EVANIIDÆ.

21. EVANIA APPENDIGASTER *Linn.*

One ♀ from Eleuthera, July 9.

FAMILY CHALCIDIDÆ.

22. TRIGONASPIS FLAVICOLLIS *Mayr.*

One ♀ from Bahia Honda, Cuba. A species described from Brazil. It is found associated with fig-insects (*Blastophagæ*) and no doubt these insects also occur on the Island.

23. EUPELMUS sp.

One ♀ from Eleuthera, July.

24. EUPELMUS sp.

One ♀ from Eleuthera, July.

THE SAPROPHYTIC FUNGI OF EASTERN IOWA. THE PUFF-BALLS.

BY T. H. MACBRIDE AND NORRA ALLIN.

THE puff-balls constitute an exceedingly interesting section of our fungous flora. They include the largest forms known to the class and are so common as to be in most of their forms very generally observed and named by the common people. To the botanist they possess especial interest as being the highest of their class, *i. e.* as evincing the limit of differentiation in the possibilities of fungal life; in diversity of form, special adaptations for the dispersal of their spores and general complexity of structure throughout, the puff-balls as a group transcend all other fungi.

The most striking characteristic of the puff-balls is the fact that their spores are internally developed and remain in the interior of the fructification until ready for dispersal. (See vol. I, p 33 and p. 181). The basidia, hyphal branches upon which the spores finally appear, project into chambers of greater or smaller dimension and regularity and these chambers suggest for the group containing the puff-balls its scientific name, *Gasteromycetes* (Greek, *gasteron*, a sac, etc.). The form and character of the spore-chamber, its development and final dehiscence vary greatly within the limits of the group as will in the course of our further discussion of the subject well appear, but the variations all have reference to the one function of spore-dispersal; the general formation of the spores is the same in all.

As to their life-history, some of the puff-balls seem to be annuals, that is, from the spore develop to complete fructification in a single season. Most, however, seem to be perennial; at any rate their mycelial or vegetative phase endures for many months or possibly years before ever fruit is formed at all. In the case of the very largest forms it is probable also that fruiting when it does occur entirely exhausts the mycelium and so terminates for the time the history of the species for that locality. Some species appear in fruit again and again in the same locality doubtless continuing as long as the substratum continues to furnish the requisite nutrition. Details as to spore-formation are given under each section.

The habitats are various. Many are lignatile, occurring on logs, stumps, half-buried sticks, boards or ligneous fruits; others are terrestrial, but even these, of course, depend for their nutrition upon the decomposing organic matter, remains of leaves, stems, twigs, buried in the humus. Some of the terrestrial forms are even subterraneous, but unfortunately none of these have so far here been brought to our attention. They are probably overlooked.

In popular estimation puff-balls are always noxious if not poisonous. According to Fries such is their most ancient reputation. Scotch people call them "blin' ba's" alluding to the notion apparently common that the dry spores affect the eyes. On the other hand it may be said that in Europe, at least, especially southern Europe, several species have long been recognized as suitable for food, some are even reckoned delicacies. It is probable that few are poisonous, although the greater number are inedible simply because unfit to eat, woody, bitter, etc. The effect of the spores upon the eyes is purely mechanical, and probably in no wise different from that of any other dust. Spores and capillitium were at one time regarded as possessed of special styptic properties, but such agencies in surgery have fallen into disuse.

Puff-balls frequent the warmer or temperate regions of the globe and are found in every land. Those of North America have been less perfectly studied. *The United States Species of Lycoperdon* by Dr. Chas. H. Peck, *North American Gasteromycetes* by A. P. Morgan, and *Morels and Puff-balls of*

Madison, Wisconsin, by Prof. Wm. Trelease, constitute the principal American literature on this subject.

The group *Gasteromycetes* as a suborder of the order *Basidiomycetes* may be thus defined:

GASTEROMYCETES (*Fries*) *Willd.*

Fungi, terrestrial or more rarely lignatile, attaining in some cases great size, developed from more or less wide-spreading mycelium which at the point of fructification converges to produce the sporocarp and usually in rhizoidal fashion binds it fast to the substratum; sporocarp consisting essentially of a closed sac or peridium, generally double, within which is developed a variously modified hyphal structure the gleba, with numerous hypha-walled secondary sacs or chambers lined or filled by the basidiosporous hymenium; basidia various, bearing apical or lateral spores often in fours; spores spherical or elliptical, hyaline or variously tinted.

The sub-order is variously divided into families by different authors according as each recognizes some special distinction in the manner in which the hymenium is enclosed. For instance, Saccardo divides the sub-order into four families *Phalloidieæ*, *Nidulariaceæ*, *Lycoperdaceæ* and *Hymenogastraceæ*, while Winter has six families, *Phalloideæ*, *Hymenogastreæ*, *Sclerodermeæ*, *Tulostomeæ*, *Lycoperdineæ* and *Nidularieæ*. Morgan combines these two schemes. His classification contains five families, the *Tulostomeæ* and the *Lycoperdineæ* being united under the *Lycoperdaceæ*. Since the *Tulostomeæ* and *Lycoperdineæ* are easily distinguished, Winter's classification seems to better subserve the convenience of the student and is accordingly here, with slight modification, adopted.

KEY TO THE FAMILIES OF THE GASTEROMYCETES.

I. Sporocarp tuberous; mostly underground species; peridium concrete with the gleba, indehiscent, cells of the gleba persistent; capillitium wanting. . . . . HYMENOGASTREÆ.

II Sporocarp globose, tuberous, terrestrial; peridium discrete from the gleba; cells of the gleba subpersistent, with little or no capillitium. . . . . SCLERODERMEÆ.

III. Sporocarp globose, long stipitate; peridium persistent, at maturity dry, opening by a definite aperture; gleba and capillitium also dry persistent; sterigmata lateral. . . . . TULOSTOMEÆ.

IV. Sporocarp traversed vertically by the well developed columella which is an upward growth or continuation of the stipe; gleba in our genus septate. . . . . PODAXINEÆ.

V. Sporocarp terrestrial, of various forms; peridium with a more or less thickened base; breaking up irregularly, or falling away, or opening regularly; at maturity filled with a dusty mass of mingled threads and spores. . . . . LYCOPERDINEÆ.

VI. Sporocarp cup-shaped or cyathiform, open at the top, containing one or more persistent hymenial chambers, the peridiola. . NIDULARIEÆ.

VII. Sporocarp at first ovate, consisting of the stipe, gleba and peridium; peridium complex, of several distinct layers, at length irregularly ruptured in such way as to form a volva out of which rises a peculiar stipe or receptacle displaying the mucilaginous gleba. . . PHALLOIDEÆ.

I. HYMENOGASTREÆ.

(This family is not represented in our collection.)

II. SCLERODERMEÆ.

Sporocarp depressed globose, with a thick, leathery, peridium breaking irregularly; the gleba cellular; at maturity the walls of the hymenial chambers drying up but persisting as such; capillitium lacking or scant. The only genus is

I. SCLERODERMA.

Peridium dry, leathery or corky, simple, gleba at first elastic fleshy, white, at length becoming dry and dark colored. The hymenium filling up the cells of the gleba as with hyphal tissue, at length dissolving so that only the spores and indistinguishable remnants remain of a capillitum which originally consisted of single cells or rows of cells derived from the hyphæ of the trama. The trama when dry perists as a fragmentary, easily perishing network.

SCLERODERMA VULGARE *Horneman*, *Flora Dan.*

Sporocarp depressed globose, of various forms and sizes, sessile or umbilicate below, tough, hard, corky or woody;

peridium variable in color, yellow, orange, reddish, or chestnut-brown, smooth, scaly, or warty, at length breaking irregularly at the top; gleba in young specimens pallid, soon becoming blue-black; capillitial remains gray; spores in mass blue-black, by transmitted light brownish, globose, spiny, 9–14 μ in diameter.

Very common, and easily recognized by the characters cited. Our specimens are usually an inch or two in diameter and about half as high, attached by mycelial strands remarkably resembling roots. In pastures, woods and fields. August–October.

III. TULOSTOMEÆ.

Sporocarp globose, at maturity surmounting a long slender cylindric stipe; peridium double, the outer verrucose or squamose, deciduous, the inner thin, papery, opening by a regular apical mouth; gleba not cellular but made up of an almost undifferentiated mass of uniform basidia-bearing hyphæ, developed from and adhering to the inner peridum; capillitium of delicate interwoven branching hyphæ appearing at the time of the deliquescence of the basidia, the ends sometimes clavate; spore-mass ochraceous-yellow; spores laterally produced, rough, small.

Easily distinguished from all other puff-balls by the stipitate habit, especially by the character and insertion of the stipe, which is long and slender and covered above by the base of the sporocarp proper as by a cap.

I. TULOSTOMA.

The only genus.

1. Tulostoma mammosum (*Micheli*) *Winter*.

Sporocarp globose, light-brown on a long slender stipe, with a fibrous mycelium; outer peridium of minute brown scales soon disappearing; inner peridium thin, membranaceous, smooth, white or light brown, opening by a small, circular, prominent ostiole; stipe bulbose at base, cylindrical, stuffed, of uniform thickness, straight, brownish, more or less squamulose, at length smooth and glabrous, grooved and hollow; gleba yellowish, loose; capillitial threads long, slender, hyaline, about as thick as the spores, branched; spores globose, with scattered warts, yellow, 4–5 μ in diameter.

Common in sandy places by streams and in alluvial soils, September–October. Especially abundant along the sandy banks of the Iowa river, where hundreds of specimens may be seen with each recurring autumn. Other species have been reported east and west of us, but so far this is only form in Iowa.

IV. PODAXINEÆ.

Sporocarp of various shapes, stipitate, the stipe percurrent; capillitium variable, often entirely wanting; the gleba also variable in structure sometimes septate, cellular, sometimes not.

The forms here included constitute a somewhat heterogeneous aggregation. In some of the species we are reminded at once both of the Hymenomycetes and the Gasteromycetes. The characteristic feature, however, distinguishing this family from all others, is the percurrent stipe.

I. SECOTIUM.

Sporocarp stipitate, at first everywhere closed, at length breaking irregularly at its lower margin into segments, central stipe distinct, not cellular, reaching the apex of the peridium; the gleba cellulose, spongy, divided into chambers by anastomosing, membranaceous plates; capillitum wanting, spores for the most part ovate, colored, appearing in groups of from two to four upon obovate, clavate or cylindrical basidia.

1. SECOTIUM WARNEI *Peck.*

Peridium subglobose, ovate, or oblong, squamulose with thick roundish scales, white, gray or brown, sessile or short-stipitate, base at length breaking longitudinally, into 4–6 parts; gleba at first white, then yellow, at length brownish-ochraceous; spores sub-globose or ovate elliptical, 6–10 μ long.

A remarkable species, little resembling any thing else and yet perhaps sometimes mistaken for some brown-spored agaric which has failed to open or expand. First described by Dr. Peck from Illinois, it has since been reported from several States from Nebraska to Pennsylvania, Very common here in autumn about drift-wood in low places, alluvial meadows, etc.

V. LYCOPERDINEÆ.

Sporocarp globose or turbinate; in habitat, terrestial or lignatile; peridium double, at maturity dry, breaking up irregularly or opening regularly with characteristic well defined mouth. Gleba consisting generally of two parts, a sterile basal portion and a fertile cellular portion with a capillitium. At maturity all internal structures disappear except the capillitium and the spores so that that the interior of the sporocarp presents simply a dusty flocculent mass. Spores borne at the apex of the basidium.

The peridium in the *Lycoperdineæ* consists of two separable membranes generally very different from each other. These are distinguished as the outer and inner peridia. The outer is sometimes a stout thick coat, sometimes a delicate fragile structure, breaking up into warts. spines, scales, etc., or entirely evanescent. The inner, generally more delicate, is often papery and thin especially at maturity.

In the gleba two sorts of hyphæ may be distingushed. The first make up the chamber-walls and consist of thin, delicate walled, richly protoplasmic, septate threads, whose ultimate branches constitute the basidia. Developed partially in the trama, partially diagonally through the cells of the sporocarp run the hyphæ of the second form; these are thicker, firmer walled, rarely septate tubules rising as modifications of the more delicate tramal hyphæ. The tramal hyphæ at maturity almost entirely disappear, often with considerable effusion of water, as do also the basidia and there remain only the hyphæ of the thick walled form which constitute the so-called capillitium. The capillitial threads subsequently become larger, their walls more thickened and commonly distinctly colored.[1]

---

[1] C. F. Winter *Crypt. Fl. Deutschlands*, Vol. 1, Pt. 1, p. 893.

TABLE OF GENERA OF THE LYCOPERDINEÆ.

A. Peridium sessile, base more or less thickened.
  1. Peridium opening irregularly by the breaking up of its walls. . . . . I. CALVATIA.
  2. Peridium opening by a definite apical mouth.
    a. Threads of the capillitium long, delicate, simple or rarely branched. . . . . II. LYCOPERDON
    b. Threads of the capillitium short, several times dichotomously branched. . . . . V. BOVISTELLA.

B. Peridium sessile, base not thickened nor stem like.
  Peridium plainly double.
    a. Peridia stellately reflexed.
      * Inner peridium stellately reflexed. . VI. MYCENASTRUM.
      ** Outer peridium stellately reflexed. . . VII. GEASTER.
    b. Peridia not stellately reflexed.
      * The dehiscence basal. . . . . . . IV. CATASTOMA.
      ** Dehiscence apical, definite or irregular; capillitium abundant dichotomously branched. . . . . . III. BOVISTA.

I. CALVATIA (*Fries*) *Morgan.*

Sporocarp large, globose and sessile or turbinate with a well developed stem-like base, terrestrial, attached to the ground by mycelial strands often thick and cord-like; peridia distinct, the outer thin smooth or granular often soon dissipated, the inner thick but fragile, after maturity breaking up into fragments from above downwards and so disappearing; the gleba, capillitium and spores, dense, persistent finally dissipated by the wind, the columella in some cases long remaining, definitely limited above; capillitial threads long, slender, abundantly branched and intricately interwoven; spores globose, minute.

This genus as now defined includes the largest puff-balls of the order. Specimens are often solitary, at most gregarious.

The genus founded by Fries to receive the *Bovista craniiformis* of Schweinitz, has no features which are not equally characteristic of several other species heretofore assigned usually to the genus *Lycoperdon*. We accordingly follow Morgan in abstracting from the old genus *Lycoperdon* all the the species opening by a deciduous inner peridium.

KEY TO THE SPECIES OF CALVATIA.

I. Peridium entirely sessile.
  a. Outer peridium covered with fine white granules or smooth. . . . . 1. C. BOVISTA.
  b. Outer peridium areolate with white patches. . 2. C. PACHYDERMUM.
II. Peridium with a short thick stem-like, base.
  A. Spores purple. . . . . 3. C. CYATHIFORMIS.
  B. Spores olivaceous.
    a. Peridium breaking stellately. . . . . . 4. C. CÆLATUM.
    b. Peridium breaking irregularly.
      1. Outer peridium areolate with abundant brown scales. . . . . 5. C. HIEMALIS.
      2. Outer peridium granular. . . . . 6. C. CRANIIFORMIS.

1. Calvatia bovista (*Linn.*) *Macbride*.

Sporocarp sessile, mycelium-attached, globose or subglobose, large, 10–20 inches in diameter; outer peridium a delicate, scarce distinguished, closely adherent layer; inner peridium thin, at first tough, leathery, at length exceedingly fragile, breaking from above downwards, white then olivaceous or brownish; capillitium comparatively scant, the threads long, septate, much branched, greater than the spores; spore-mass dark olivaceous-brown, long persistent; spores minute, nearly smooth, 3–4.5 μ.

This is the "giant puff-ball" of all the world. It occurs on meadows, lawns, pastures and sometimes in open woodlands, and might be rather common save for the perversity of some people who take pleasure in destroying natural objects, especially such as are large enough to attract the attention of their obtuse faculties. When young the gleba of specimens of this species is perfectly white, clean, rich in protoplasm and when properly cooked, delicately flavored and nutritious. The peculiar power of self-restoration possessed by the sporocarp may be made use of in such way that slices for the table may be taken from a specimen day after day without serious injury to the fungus, and this may be continued as long as the tissues continue growing. Once deliquescence sets in the tissues are, of course, no longer edible.

Specimens often occur in groups, gregariously, as many as twenty or thirty within the limits of an acre. In such cases no one specimen is very large, the largest perhaps ten inches in diameter. Isolated individuals, on the other hand, reach remarkable dimensions. Our largest specimen was 16 inches in diameter; specimens three feet in diameter are reported.

By the ancients the giant puff-ball was denominated *bovista*, doubtless because of supposed medicinal value in veterinary practice. "Pulvere maturo hujus et afinium cum lacte mixto Borussi Fennones in diarrhœa boum utuntur." *Fries*, Syst. Myc. III, 30. Linnæus wrote *Lycoperdon bovista;* Schæffer, *L. maximum;* Morgan *Calvatia maxima*, etc.

2. CALVATIA PACHYDERMUM (*Peck*) *Morgan.*

Sporocarp subglobose, 4–6 inches in diameter the rooted base somewhat pointed; outer peridium thin, smooth, whitish, the upper part cracking into small, irregular, persistent, spot-like scales or areas; inner peridium thick, sub-corky, somewhat brittle above, at length breaking up into irregular fragments; capillitium and spores ochraceous-brown; threads long, flexuous, somewhat branched; spores subglobose or broadly elliptical, 4–6 $\mu \times$ 5–7 μ.

Growing on the ground.

Our best specimen is very large being about 16 inches in diameter or 4 feet in circumference. The thin, white, outer peridium breaks first and shrinks back in patches somewhat smaller than the fragments of the inner peridium which follows, in breaking, the same lines. We have one specimen from Guthrie County about 12 inches in diameter and one from Muscatine about 16 inches in diameter, both much larger than the description would seem to warrant, but the species is so well marked that there can be no doubt of correct reference.

Rare. The range seems westward. Reported so far heretofore from Dakota and Arizona.

3. CALVATIA CYATHIFORMIS (*Bosc*) *Morgan.*

Sporocarp 2–4 inches wide, broadly obovoid or turbinate, depressed or flattened above, with a short, thick base and cord-like root; outer peridium smooth, thin fragile, easily peeling off, whitish-brown to brownish-purple. upper part often cracking into areas: inner peridium thin. pale to dark purple. fragile, velvety, at maturity breaking up into fragments and falling away: base occupying nearly half of the peridium. cup-shaped above, persisting a long time: capillitium and spores brownish-purple; threads very long, thinner than the spores, scarcely branched; spores globose, rough, spiny, 4.5–5 μ in diameter.

Growing on the ground in meadows and pastures. common and widely distributed. The persistent sub-gleba or base is a curious structure, often enduring through the winter and often collected as a perfect specimen. It is a cushion-like object. stands sometimes eight inches high. surrounded by a projecting frill, the remains of the vanished peridium; the upper surface smooth, having been always structurally distinct from the gleba proper. Small forms of the present species seem to represent the *Lycoperdon fragile* of Vittadini. The fresh mature spore-mass in all is purple, richly beautiful.

4. CALVATIA CÆLATA (*Bull.*) *Morgan.*

Sporocarp large, obovoid, obconic or turbinate, depressed above, about 5 inches in diameter. the base stem-like, stout. thick and with a cord-like root: outer peridium thick, floccose breaking irregularly into large areas covered with large wart-like scales. dull brown in color; inner peridium thinner. fragile. at length irregularly ruptured. chiefly along the lines suggested by the breaking of the outer peridium finally showing a large. irregular. lacerate aperture: both peridia at length fall away above leaving a cup-shaped base with a lacerate margin. persistent: capillitium and spores dense. greenish-yellow, changing to amber: threads very long, much branched. brittle: spores globose. smooth. yellowish-brown. sometimes with a minute pedicel, 4–5 μ in diameter.

Growing on the ground chiefly in open woods. Easily distinguished from other similar forms by its peculiar dehiscence. Not common.

5. CALVATIA CRANIIFORMIS (*Schw.*) *Fries.*

Sporocarps large. 3–7 inches in diameter. gregarious. obconic or turbinate with stem-like base; strongly depressed-flattened above; the stipe often short, generally from one-half to two-thirds the entire height, coarsely cellular within, stout, thick, contracted below and mycelium attached; outer peridium thin, furfuraceous, transparent, breaking up into rather small areoles; the inner peridium thicker, velvety, extremely fragile; after maturity all the upper parts of both peridia deciduous; gleba bright yellow or greenish-yellow, becoming darker with age, compact, persistent: capillitial threads long, branching freely; spores smooth, short-pedicellate, about 3.5 μ.

Formerly not uncommon in undisturbed woodlands, where in autumn great numbers of individuals could be found within quite narrow limits; now much less seldom seen. As in cognate species, it sometimes happens that a single large specimen occupies the ground; usually, however, several are found plainly the product of one mycelium. The stipe is but an exaggerated columella or sub-gleba remarkable for its coarse cellular structure. The entire gleba at length disappears, leaving only the sterile, now cup-shaped base.

Delaware, Johnson, Muscatine counties.

II. LYCOPERDON (*Tourn.*) *Morgan.*

Sporocarp globose or pear-shaped, generally more or less distinctly stalked, or furnished with a stem-like base; peridium double, the outer usually, at least partially, deciduous, often consisting chiefly of warts, spines or granules; the inner thin, papery, persistent, dehiscent by a regular apical mouth; gleba variously tinted, purple, olivaceous or olivaceous brown, the capillitium of slender delicate threads arising both from the peridium and the columella; the sub-gleba usually coarsely cellular.

The Lycoperdons are at first white or yellowish-white, soft and moist within, and in this condition are said to be edible. The upper surface is nearly always rough, warted or spinescent at first, later, generally smooth. The spores mature with liquefaction of some of the hyphal elements after which they assume the color characteristic in the several groups.

KEY TO THE SPECIES OF LYCOPERDON.

I. Spores at maturity purplish brown.
  a. Outer peridium of long convergent spines. 1. L. PULCHERRIMUM.
  b Outer peridium of short convergent spines or hairs. . . . . 2. L. ATROPURPUREUM.
  c. Outer peridium of minute spinules. . 3. L. ASTEROSPERMUM.
  d. Outer peridium a furfuraceous persistent coat. . 4. L. ELEGANS.

II. Spores at maturity olivaceous brown.
  A. Sporocarp turbinate, usually with stem-like base.
    a. Outer peridium furfuraceous or with very small warts or spines, inconspicuous.
      1. Sporocarp terrestrial. . . . . . 5. L. MOLLE.
      2. Sporocarp lignatile. . . . . 6. L. PYRIFORME.
    b. Outer peridium showing conspicuous wart-like spines some long, some short. . . . . 7. L. GEMMATUM.
    c. Outer peridium showing conspicuous spines convergent at the tip; spores pedicellate . . . . . 8. L. PEDICELLATUM.
  B. Sporocarp more or less globose.
    a. Outer peridium inconspicuous. . . . 9. L. PUSILLUM.
    b. Outer peridium of conspicuous converging spines. 10. L. PECKII.

1. Lycoperdon pulcherrimum *B. & C.*

Sporocarp obovoid, 1–1½ inches in diameter, with a short stout more or less pointed base; outer peridium consisting of very long white spines, converging and generally coherent at the apex, at length deciduous; inner peridium smooth, or furfuraceous, brown, sometimes slightly reticulate: sub-gleba one-third of the entire fructification; gleba at first white then olivaceous then purplish-brown: threads of the capillitium much branched, main stem thicker than the spores, branches long, slender, tapering; spores globose, minutely warted, usually stalkless, about 5 μ in diameter.

Very common everywhere in low grounds. The species easily distinguished by the character of its spines. No other comes near to it in shagginess. The spines are deciduous and at maturity, especially in wet weather, all fall off from above downwards, leaving the bald, brown inner peridium to open, somewhat irregularly, at the apex.

2. Lycoperdon atropurpureum *Vitt.*

Sporocarp sub-globose, 1–2 inches in diameter, often irregular, with a plicate base and fibrous mycelium; outer peridium white, cinereous or brownish consisting of soft slender spines or hairs, which at length fall away leaving the smooth, shining brownish-purple surface of the the inner peridium; sub-gleba, broad about one-third of the peridium; mass of spores and capillitium olivaceous then purplish-brown; capillitial threads about equal to the spores with long, acuminate branches; spores globose, spinescent, pedicellate, 5–7 μ.

Rare. Found occasionally in woods or sandy pastures.

The warts of the outer peridium are something like those of *L. gemmatum*, and from their color, immature specimens might possibly be mistaken for that species. The present species is, however, solitary and sessile and the peridial warts are nearly uniform, all of one size, generally with a reddish tinge when the plant grows in the shade.

3. Lycoperdon asterospermum *Dur. & Mont.*

Sporocarp obovoid or short-turbinate, 1–1½ inches in diameter, short and pointed below with a fibrous rooting mycelium; outer peridium a thin coat of closely set minute spinules presenting a granular appearance to the naked eye, yellowish or brownish above, paler below, at length deciduous; inner peridium dull yellow, smooth, shining, very thin but papery and persistent; sub-gleba obconic, about one-third the height of the peridium; gleba at maturity, brownish-purple, the capillitial threads about equalling the spores, the branches, long acuminate, spores globose, warted, 5–6 μ.

Not rare on the ground in open woods and orchards. Distinguished from the preceding by its much more delicate outer peridium, by the thin, shining, persistent inner peridium and the bright brown capillitium, persisting after the spores are blown away.

4. Lycoperdon elegans *Morgan.*

Sporocarp large, 1½–3 inches in diameter, depressed globose, plicate beneath, and sometimes with narrow unboniform base, which is continuous with the thick root; outer peridium at first flocculose, white or yellowish, drying up into a dense furfuraceous coat, which becomes brownish in color, and sometimes obscurely areolate: sterile base occupying nearly one-half of the peridium: mass of spores and capillitium olivaceous, then purplish-brown; threads much branched, main stem thicker than the spores, branches long and tapering: spores globose, distinctly warted, 5–6 μ in diameter.

This species was described by Mr. Morgan from a specimen collected in Muscatine County, Iowa, several years ago. The locality which furnished the specimen is a peculiar one, its entire flora in many respects unique. Probably a dozen species of the higher plants here occur not seen elsewhere in the State.

The chief distinguishing characteristics are the smooth, evanescent outer peridium, the curiously evenly plicate base, and the largely developed, coarsely cellular sub-gleba. The latter remains yellow or yellowish-gray in strong contrast with the rich brown gleba above. Two other smaller specimens since taken in the same locality seem to confirm the original diagnosis. Under the pine trees on the same hill-top which furnishes these specimens *L. craniiformis* is year by year abundant.

5. LYCOPERDON MOLLE *Pers.*

Sporocarp an inch or two in diameter, turbinate, depressed above, below abruptly contracted into a short, thick, stem-like base, mycelium-attached: outer peridium a thin mealy-furfuraceous, sub-persistent coat, white or yellowish in color, at length deciduous; inner peridium smooth, shining, olivaceous or brown, thin and comparatively fragile: sub-gleba, about one-third of the peridium: mass of spores and capillitium dull olive; becoming brownish: threads, branching, equal to the spores, very minutely roughened, with a small distinct pedicel, about 4 μ.

On the ground in open woodland. This species is distinguished by the mealy character of its warts. It is the smoothest turbinate species we have. In wet weather the inner peridium has a tendency to crack in areas. Fries referred this species as a variety to *L. gemmatum*, var. *furfuraceum*, and Winter followed his classification. It differs essentially from *L. gemmatum* in the the character of the warts.

6. LYCOPERDON PYRIFORME *Schæff.*

Sporocarps ½–1 inch in diameter and of about equal height, usually densely cespitose or crowded, lignatile, obovoid or obconic with short pedicel, mycelium-attached with abundant white strands; outer peridium of scattered, dark brown warts or short spines, persistent and sometimes areolate; inner peridium pale, thin, tough; gleba olivaceous, capillitial threads thicker than the spores, branched; sub-gleba white felt-like of very small cells, spores globose, smooth, about 4 μ.

Abundant on old logs or stumps, or more rarely on the ground; usually cespitose, and sometimes extending several feet, hundreds together! "The commonest of all puff-balls; distributed throughout the whole world." It is easily distinguished by its shape, the persistent character of the warts and by its reddish appearance when dried. Some specimens collected here resemble *L. molle*, but are smaller and distinguished by the character of the warts, which are those of *L. gemmatum*. From the latter species *L. pyriforme* is distinguished by its shape and by the white sub-gleba.

7. LYCOPERDON GEMMATUM *Batsch.*

Sporocarps more or less cespitose, turbinate-stipitate, flattened above, plicate and abruptly tapering beneath, lignatile or sometimes terrestrial, from a fibrous mycelium; outer peridium consisting of numerous spike-like warts with many smaller ones interspersed, brownish or reddish, the larger first deciduous, leaving a spotted, as if reticulate, surface; inner peridium thin, tough, persistent, opening by a well-defined mouth; gleba at first greenish-yellow, then brown, the capillitial threads arising from the peridium and sub-gleba, generally simple, equalling the spores; sub-gleba well developed arising within the peridial cavity as a spherical columella; spores, globose, minutely roughened, about 4 μ.

A very common species, usually on rotten stumps, logs, etc., in great crowded colonies, their thick, elongate cylindric stipes raising the sporocarps an inch or two above the surface. The peculiar brown translucent conical spines constitute the "gems" with which the upper surface is clothed. These fall off so as to leave white round scars, which to the naked eye assume a reticulate pattern. A form occurs in which the spines are sharper, more abundant, black or dark brown in general effect against a gray inner peridium, but otherwise as above. This appears to be *L. perlatum* Pers. It may be esteemed a recognizable variety.

8. Lycoperdon pedicellatum *Peck.*

Sporocarp globose or broadly ovoid, ¾–2 inches in diameter, narrowed into a stem-like base, with a slender fibrous mycelium. Outer peridium gray changing to smoky brown, consisting of long rather dense spines convergent at the apex; these at length fall away, leaving a wrinkled or obscurely reticulated surface to the pale glabrous inner peridium; sterile base small, occupying about a fourth part of the peridium; mass of spores and capillitium greenish-yellow then brownish; threads much branched, main stem thicker than the spores; spores globose, smooth, 3–4.5 μ in diameter, with persistent pedicels three to five times as long.

Growing on the ground and decaying wood in the woods. Instantly recognized by the long, persistent, pedicels of the spores. Superficially the species resembles some phases of the preceding species but is distinguished by the converging spine-tips. Not uncommon. September.

9. Lycoperdon pusillum *Batsch.*

Sporocarp small, less than an inch in diameter, globose sessile, rooted; the outer peridium a thin coat of minute granules or scales; furfuraceous, inner peridium pale, exceedingly thin, papery but tough withal; gleba greenish-yellow or olivaceous becoming darker, the capillitial threads abundantly branched about equal to the spores; sub-gleba small but distinct, coarsely cellular; spores globose, nearly smooth, 4 μ.

Not common; occuring occasionally in old fields or undisturbed woods in small colonies, half a dozen individuals in a place. The surface is like that of *L. molle* though more delicately roughened. The globose form will distinguish it from any other species in this list except the next; *L. peckii* exhibits converging spines.

10. LYCOPERDON PECKII *Morgan.*

Sporocarp small ½–1 inch in diameter, clustered or solitary; depressed globose with a short stem-like base, mycelium-attached; outer peridium of short, close-set spines clustered and convergent at the apex, long persistent but at length deciduous; inner peridium smooth, fragile especially above; gleba at first olivaceous yellow, then brownish; sub-gleba coarsely cellular and concolorous; capillitial threads about equalling the spores, with few branches; spores globose, warted, 4.5 μ.

This is a common little species on the ground in thinly covered meadows, pastures, etc. It seems to affect our loess (clay) soils. We have never seen it anywhere else nor growing on good soil. The spore-mass in some of its transitional shades might be called purple and would suggest with the warted surface small specimens of *L. pulcherrimum* from which species the smaller shorter spines readily distinguish it.

III. BOVISTA *Pers.*

Sporocarp globose sessile, without columella or sterile sub-gleba; peridium double, the outer almost completely deciduous; capillitium threads distinct, separable, each consisting of a short thick, stem-like portion which branches more or less regularly dichotomously, the ultimate branches acuminate.

This genus is sharply distinguished from *Lycoperdon* by the character of the peridia as well as by the capillitium. The number of species is small; in Iowa not more than two, so far reported, but these are exceedingly common.

1. BOVISTA PILA *B. & C.*

Sporocarp globose or depressed, sessile, attached by a cord-like mycelial strand; outer peridium thin, white, at length squamulose, deciduous; the inner peridium tough, rigid, long persistent, at first reddish or reddish-brown, at length silvery, perfectly smooth, the dehiscence irregular, more or less apical; sub-gleba none; spore-mass at first ochraceous then brown, compact: capillitial threads short, much thicker than the spores, branched, the branches acuminate: spores brown, globose, nearly smooth, sometimes short-pedicelled, 5 μ.

Exceedingly common everywhere throughout the wooded portion of Iowa and even in planted groves over the prairie. The inner peridium persists indefinitely and becomes dehiscent only after long weathering and tossing about on the surface of the ground, in this respect unlike any other puff-ball of this region.

B. nigrescens Pers. to which the present species is closely related has pedicellate spores; otherwise just the same. It may be fairly questioned whether *B. pila* is entitled to specific rank.

2. Bovista plumbea *Pers.*

Sporocarp globose, ¾–1¼ inches in diameter, sessile, mycelium-attached; outer peridium thin, smooth, falling away in scales, only that part near the base remaining attached; inner peridium papery, flexible, lead-colored, with a narrow ostiole; capillitium and spores soft, loose, ochraceous then brown; threads three to five times branched, branches long, straight; spores long-pedicelled, rough especially toward the apex, oval, about 5×7 μ.

Very common on meadows, pastures and lawns, at first white, the inner peridium clear lead-color, dehiscent by a definite, but lacerate apical aperture, at first white-bordered. Differs from the preceding in the color of the inner peridium and in the spores rough and long-pedicellate.

IV. CATASTOMA *Morgan.*

Mycelium filamentous, proceeding from all parts of the surface. Peridium subglobose, without a thickened base; a fragile coat of loosely interwoven hyphæ, after maturity torn asunder, leaving the lower part in the ground and a cup-shaped portion adherent above; inner peridium subcoriaceous, dehiscent by a basal aperture. Capillitium originating from the inner surface of the peridium; the threads long, branched, sub-hyaline, after maturity gradually breaking up into short pieces, which appear among the spores as free, short, simple or scarcely branched threads with blunt extremities; spores globose, warted, pale-brown, sessile or pedicellate.

Puff-balls growing beneath the surface of the ground and connected immediately with it by filamentous threads, which issue from every part of the cortex; after maturity, when the peridium breaks away, the lower part of the outer coat is held fast by the soil, while the upper portion, which has attained the surface, remains covering the inner peridium like a cap or inverted cup; consequently the apparent apex at which the mouth is situated is the actual base of the plant as it grows. The capillitium threads are similar to the densely interwoven hyphæ, which form the inner peridium and are evidently branches of them radiating into the interior.—*A. P. Morgan*, Cin. Soc. Nat. Hist., Vol. XIII, p. 142.

From *Bovista* this genus differs chiefly in its inverted habit. Aside, however, from the circumstance that it grows mouth downward it is peculiar in its mycelial attachment to the surrounding soil. To form the outer peridium soil and hyphæ blend in about equal proportions.

1. Catastoma subterraneum (*Peck*) *Morgan*.

Fungi subgregarious; sporocarp subglobose, immersed in soil, about one inch in diameter; outer peridium white or grey from the adherent soil, fragile, circumscissile; inner peridium smooth as in *Bovista*, pale, becoming brown and then weathering to white again, dehiscent at length at the base by an irregular aperture; spore-mass and capillitium brown, lax; capillitial threads usually long and flexuous, sparingly branched; spores globose, sessile, rough, 6–8 *u*.

This little species was first sent from South Dakota by Mr. C. W. Irish to Dr. Chas. H. Peck, and by him described as

Bovista subterranea, Bot. Gaz., v. 216, 1879. It does not appear so far in our collections from eastern Iowa, but has been sent in from our western counties. It is an inhabitant of dry prairies and in some parts of South Dakota literally covers the ground, as, for instance, in the valley of the Cheyenne.

V. BOVISTELLA *Morgan.*

Mycelium funicular, rooting from the base. Sporocarp subglobose, with a well developed base; outer peridium a dense floccose sub-persistent coat: inner peridium membranaceous, dehiscent by a regular apical ostiole. Sterile portion cellulose, cup-shaped above and definitely limited, persistent; capillitium originating within the tissue of the gleba; the threads free, short, several times dichotomously branched, the main stem thicker than the diameter of the spores, the branches tapering; spores small, globose or oval, smooth, pedicellate.

A puff-ball of moderate size, growing in fields and open woods; it has the peridium of a Lycoperdon and the capillitium of a Bovista. The threads of the capillitium originate within the tissue of the gleba, along with the spores, and after deliquescence are left perfectly free within the peridium; they are altogether different from the slender sub-hyaline hyphæ which compose the wall of the inner peridium and have connection with them.

1. BOVISTELLA OHIENSIS *Ellis & Morgan.*

Sporocarp globose or broadly ovoid, 1½–3 inches high and about the same in diameter, sometimes much depressed, plicate underneath, with a thick cord-like root; outer peridium a dense floccose coat, sometimes segregated into soft warts or spines, white or grayish in color; this dries up into a thick buff-colored or dirty brown layer, which gradually falls away, leaving a smooth, shining, pale brown surface to the inner peridium; sterile portion broad, ample, occupying nearly one-half of the peridium, a long time persistent; mass of spores and capillitium lax, friable, clay-colored or pale brown, threads pale brown, 3–5 times branched, the branches tapering, main stem much thicker than the spores; spores globose or oval, smooth, 4–5 $\mu \times 3.5$–4.5μ, long, persistent pedicels hyaline.—Cin. Soc. Nat. Hist., Vol. XIII. p. 141.

Rare, on the ground in pastures and open woods. Resembles *Lycoperdon* but differs at sight from any of our local species by its short conical stipe, solid sub-gleba and flat or depressed shallow gleba. N. A. F. 3306.

VI. MYCENASTRUM *Desv.*

Sporocarp depressed-globose, sessile mycelium-attached; peridium double; the outer envelope thin, white, fragile, breaking up into squamose fragments, deciduous; inner peridium, thick, tough, coriaceous, at length dividing stellately from the apex and becoming reflexed as the outer in *Geaster;* sub-gleba scant or none; gleba brown, persistent; capillitium of short, thick, sparingly branched threads.

"Puff-balls of considerable size, growing in sandy soil in dry regions. A very distinct genus, in no way related to *Scleroderma* and resembling it only in the thick, corky inner peridium. The threads of the capillitium originate within the tissue of the gleba, along with the spores, and are set free by deliquescence as in *Bovista.*"—*Morgan*

MYCENASTRUM SPINULOSUM *Peck.*

Peridium globose, sessile, two or four inches in diameter, thick, firm, whitish, externally cracking into rather large areas, the whole brown when mature and stellately splitting from above into six or seven unequal, spreading or reflexed rays; capillitium and spores in mass dark-brown with a slight purplish tinge; flocci rather short, pale, usually branched, armed with scattered unequal spinules which are more numerous near the acuminate extremities; spores globose, colored, minutely warted, 10–12 μ in diameter,

A very curious plant, appearing first in fructification as a group of solid white spheres, each three or four inches in diameter. As these progress toward maturity the color within becomes darker until it finally assumes a rich brown-purple tinge and a section of the sporocarp suggests a *Scleroderma*. Meanwhile the outer peridium breaks up and falls off in silvery scales, the inner peridium shows signs of cleavage and finally throws back four or five principal segments each of which is more or less deeply cleft at the apex. As the dehiscence becomes complete, the sporocarp is detached at base and, driven by the wind, goes rolling over the ground spilling the dry purple spores. The basal capillitium persists a long time even under these circumstances. No specimen before us is quite empty.

The habitat is rich ground, as around unused cattle-sheds, where the plant is found not rarely in autumn from year to year, generally a dozen or more at a place.

VII. GEASTER *Micheli.*

Sporocarp at first globose, closed, outer peridium at length dividing into several stellately formed segments, disclosing the globose inner peridium which then opens by one or more distinct definite mouths, or irregularly. Capillitium consisting of threads, branched or reticulately united or, more commonly, of well differentiated threads simple and separable.

The genus *Geaster* is readily distinguished through the peculiar behavior of its peridia at the time when the sporocarp matures. According to Winter the unopened sporocarp exhibits the following structure:[1] the peridial wall consists of six different layers: (1) the outermost a flocculent, brownish, fibrous envelope connected on the one hand with the mycelial threads below, on the other with the second layer; (2) a thick, dry, brown membrane enclosing the entire sporocarp. Next comes (3) a white envelope which is especially developed at the base of the sporocarp and here passes immediately into the inner peridium and gleba. The two last named layers form the fibrous envelope. The white layer is lined on the inside by the (4) colloid stratum, a somewhat gelatinous hyphal development. From the (6) inner peridium the collenchymatous layer is separated by a soft, loose hyphal tissue which may be called (5) the layer of cleavage. At maturity in consequence of the swelling of the colloid layer the outer peridium breaks up in stellate fashion, while the cleavage layer remains hanging in form of deciduous flakes, partly to the colloid layer and partly to the inner peridium. In some cases, as in *G. fornicatus* the outermost mycelial envelope becomes strongly developed enclosing in its growth particles of surrounding earth and various fragments of organic matter as in *Catastoma*, and, at the separation of the peridium from the fibrous envelope, becomes detached and forms beneath the latter an open empty sac. Upon the hygroscopicity of the colloid layer, which is very great in the case of *G. hygrometricus*, depends the peculiar property which some species possess of expanding in moist weather and closing up again when it becomes dry.

---

[1] Winter uses here *G. hygrometricus* as type; in other species the successive layers are less distinct. The principal layers in the type can be made out even with dry specimens.

TABLE OF SPECIES OF GEASTER.

A. Inner peridium pedicellate.
  a. Mouth sulcate-plicate. . . . . . . 1. G. FORNICATUS.
  b. Mouth ciliate-fimbriate. . . . . . . 2. G. LIMBATUS.

B. Inner peridium sessile.
  a. Mouth ciliate-fimbriate.
    1. Segments 4–6. . . . . 3. G. TRIPLEX.
    2. Segments 6–9 . . . . 4. G. SACCATUS.
  b. Mouth sulcate-plicate. . . . . . . 5. G. STRIATUS.
  c. Mouth lacerate. . . . . 6. G. HYGROMETRICUS.

1. GEASTER LIMBATUS *Fr.*

Outer peridium deeply parted into several segments, at length reflexed, dry, leathery, within dark brown at length yellow or grayish brown, about 4–5 in. in diameter; inner peridium about one inch in diameter, on a short, thick, generally compressed pedicel gradually widening into the apophysis which appears at the base of the globose, generally depressed, brownish inner peridium; mouth ciliate-fimbriate, depressed conical in a paler circular areole; capillitium and spores dark brown; columella prominent; capillitial threads thicker than the spores, long and tapering; spores globose minutely warted, 2.5–5 μ in diameter.

Formerly common about the stumps of our primeval trees, now rare although met with occasionally; generally more or less gregarious. One of our largest species, when expanded somewhat resembling *G. hygrometricus*, but easily distinguished by its pedicellate sac, as by other particulars. N. A. F. 1309.

2. GEASTER FORNICATUS *Huds.*

Outer peridium divided normally into 4 nearly equal segments, which bend backward almost perpendicularly and rest by their tips on the sac- or salver-shaped open outer envelope, without pale or yellowish, within brown and smooth; inner peridium about ¾ of an inch in diameter, borne upon a short, pallid, generally constricted pedicel, broadly ovoid or globose, at base with a sharply defined apophysis, grayish or brownish with a yellowish or yellowish-white areole at the top continued into the fimbriate ostiole.

Rare. On the ground in woods, especially among pine leaves. A very curious and remarkable plant, easily recognized when open by the manner in which the vaulted inner layer of the outer peridium is poised upon the expanded tips of the outer layer of the same. A more elegant device for exposing the fruit for spore-dispersal can hardly be imagined.

3. GEASTER TRIPLEX *Jungh.*

Outer peridium 4–6 parted, the thick fleshy layer breaking away about the middle and separating into two retreating parts the proximal forming a cup; the inner peridium about an inch or more in diameter, depressed-globose, sessile, pallid or brownish, the mouth broadly conic, ciliate-fimbriate, seated in a definite circular area; columella clavate, reaching to the center; capillitium and spores brown, the threads much thicker than the spores; spores globose, minutely warted, 4.5–5.5 μ in diameter.

Rather common. Growing gregariously in loose soil about old logs or stumps in the woods. The species resembles the next but has more widely expanded segments, 3–4 inches. Distinguished also by the peculiar secondary cup formed as described by the retraction of the inner layer of the outer peridium. N. A. F. 2735.

4. GEASTER SACCATUS *Fries.*

Outer peridium multifid, segments 6–8; inner peridium from ½ to 1 inch in diameter, globose, sessile, pallid or brownish; the ostiole conic, ciliate-fimbriate, seated in a definite, circular area, the areole; columella prominent, clavate, reaching the center; capillitium and spores brown; threads much thicker than the spores; spores globose, minutely warted, 3–5 μ in diameter.—*Morgan.*

Not common. Distinguished by the less widely expanded segments of the outer peridium, whence the inner peridium remains semi-enclosed, even at maturity. The curious splitting of the outermost layer of the outer peridium so that the rays are vertically lined or striate is also characteristic.

5. GEASTER STRIATUS *DC.*

Outer peridium expanded, at length reflexed, tough, leathery, smooth within, brown, outer cuticle pallid or yellowish, parted to beyond the middle into 6–8 rather uniform segments; inner peridium ½–¾ inches in diameter, globose, usually sessile, or with a very short pedicel, smooth, bluish-brown or light amber color, with a conical, prominent, sulcate-plicate ostiole, not in a definite areole; capillitium and spores brown; threads much thicker than the spores; spores globose, minutely warted 3.5–5 μ in diameter.

Not uncommon in undisturbed woods, at the base of well-rotted stumps or beside rotten oak logs. A very pretty, uniform, little species; recognizable by its elongate, striate peristome.

6. GEASTER HYGROMETRICUS (*Pers.*) *Fries.*

Outer peridium deeply parted, segments 7–20, very thick and rigid, within brownish, at length deeply fissured, without gray or grayish-brown, about 2–3 inches in diameter, when fully open; inner peridium sessile, depressed-globose, floccose-reticulated, gray or brown, with an irregular, lacerate or stellate ostiole; capillitium and spores brown; threads hyphal, long, branched, interwoven, thinner than the spores, hyaline; spores globose, distinctly warted, 5–10 μ in diameter.

This, our most common species, differs so much in many details from other species that Mr. A. P. Morgan thinks proper to use it as type of a new genus. The peculiarities of the species pertain to internal structure, especially the capillitium which is poorly differentiated. It seems to us, however, that the genus *Geaster* is so naturally and easily limited by the peculiar dehiscence of its peridia, that our convenience is more conserved by maintaining the old genus with the limits set by all mycologists from Micheli to Winter.

The variation in the size of the spores is remarkable, but there is no doubt of it, even when spores from one plant are compared. The hygroscopicity of the outer peridium is always marked, and is long retained, even after the inner peridium with its spores have entirely blown away.

VI. NIDULARIEÆ.

Spores developed in definite distinct peridioles or sporangia, few in number formed within the peridium of a larger sporocarp, which is cylindrical or cup-shaped, and at length opens to set free the sporangia.

The *Nidularieæ* constitute a group of highly differentiated fungi, small, terrestrial or lignatile, beautiful, distinguished from all others in that the ordinary glebal chambers of gasteromycetous fungi are here specialized and developed to form secondary receptacles or conceptacles for the production and retention of the spores. The sporocarp is at first globose or clavate, but presently takes on a characteristic form almost for each genus; at first closed entirely, it at length opens. sometimes irregularly, generally regularly by a definite lid-like structure, the epiphragm. The interior of the sporocarp is at first filled with a gelatinous hyphal mass in which one or more spherical or lenticular bodies, the forming sporangia, lie imbedded. In some cases, from each sporangium passes a hyphal strand or cord, the *funiculus*, binding the sporangium back to the peridial wall.

I. CYATHUS *Haller*.

Sporocarp at first obovate or fusiform, closed by a white epiphragm or membrane, then widely open at the top; peridium consisting of three layers; conceptacles eight to eighteen, thick-disk-shaped, umbilicate beneath and attached to the walls of the peridium by a compound funiculus.

Species of *Cyathus* bear, at the top of the vasiform peridium within, a delicate projecting rim or corona (*saum*) the remains of the membranaceous epiphragm. In *Crucibulum* this rim is lacking.

SPECIES OF CYATHUS.

I.	Peridium obconical, striate within. . . .	1. C. STRIATUS
II.	Peridium bell-shaped, smooth.	2. C. VERNICOSUS.

1. CYATHUS STRIATUS (*Huds.*) *Hoffm.*

Sporocarp obconical, dark-brown, short stipitate, with a fibrous mycelium; outer peridium persistent, rough, hairy, brown; inner peridium longitudinally plicate, lead-colored or brownish, glabrous; at length opening at the top by the detachment of a lid; 8–10 mm. broad at the mouth; conceptacles at first almost circular, with a broad funiculus, at length angulate, becoming whitish; spores broadly cylindrical, obtuse at both ends.

Common in the woods on old tree-trunks, moss, between fallen leaves, on nut-shells. An elegant little plant, easily recognized by its brown tubular shape, hirsute, outer peridium, white epiphragm and plicate inner surface. Sometimes an inch high. N. A. F. 729.

2. CYATHUS VERNICOSUS (*Bull.*) *DC.*

Sporocarp bell-shaped, with wide-expanded mouth, short stipitate, with a fibrous mycelium; outer peridium silky-hairy, ochre-yellow or ashy-gray, at length almost smooth; inner peridium smooth, dark gray to lead-color; conceptacles blackish, smooth, 2½–3 mm. broad; spores broadly oval, 13×7 μ.

An American species.

Not uncommon on all sorts of decaying bits of vegetable matter buried or half-buried in the ground. Not seldom found in corn-fields, on lawns, about wood-yards, etc. Distinguished from the preceding by the flaring campanulate peridium and absence of plications. N. A. F. 308.

II. CRUCIBULUM *Tulasne.*

Sporocarp at first globose then short-cylindric, closed by a furfuraceous lid-like structure, at length crucible-form the lid disappearing; the peridium simple, of but one layer; conceptacles numerous, disk-shaped, smooth, white, each with a globular process beneath, which may be prolonged into a long slender funiculus.

1. CRUCIBULUM VULGARE *Tul.*

Sporocarp globose, at first closed, sessile, white or ochraceous, with fibrous mycelium; peridium thick, furfuraceous without, satiny shining within, the lid of the peridium at length disappearing, exposing the numerous, circular, flattened, yellowish-white conceptacles from 1½–2 mm. broad; spores elliptic 5×9 μ.

Common everywhere, especially in the crevices of our wooden side-walks, which still abound, the conspicuous and unhappy evidence of a new and unfinished civilization. N. A. F. 728.

III. NIDULARIA *Fries.*

Sporocarp subglobose, saccate, reticulate, pale brown, sessile; peridium simple, thin, at length breaking up from the top downward, vasiform; conceptacles numerous, disk-shaped, lying in a gelatinous mass, without funiculus; spores globose.

1. NIDULARIA PULVINATA (*Schw.*) *Fries*.

Sporocarps 6–12 mm. wide, scattered, orbicular, pulvinate, closed, testaceous, sordid-brown, pulverulent; the sporangia of various shapes, compressed, at length, cinereous black.

Specimens referred to this species may prove to be new to science. The description from Schweinitz, here quoted from Saccardo, is too brief for positive identification. Still with the descriptions our specimens correspond fairly well. The peridia are gregarious, often confluent, pale ferruginous, the walls exceedingly thin and evanescent, at first dusty or flocculose, disappearing irregularly from above downwards. The peridioles are very numerous, heaped, at first pale, at length dull-black, oblately spherical, polished, shining.

Collected only once in Johnson county, Iowa, on a rotten oak log.

VII. PHALLOIDEÆ.

Sporocarp at first ovoid, solid, white, subterranean, attached below by root-like mycelial strands; peridium three-fold, an outer and inner coat with a gelatinous intermediate layer; gleba chambered, at first surrounding then surmounting the central columnar receptacle; peridia dehiscent irregularly above by the upward expansion of the receptacle, the gleba thus borne aloft; capillitium none, the gleba deliquescing and falling from the receptacle in drops; plants generally of offensive odor.

Plants of this family, commonly called in English, "stinkhorns," are widely distributed, perhaps throughout the world. In Europe few, in North America more abundant, they reach their highest development and show the greatest diversity of form and habit in the southern hemisphere, more especially in Africa and Australia. Their curious forms, often brilliant colors, and above all the pungently offensive odor, as of carrion, characterizing most of them, brings them into general notice; while to the naturalist they possess especial interest as evincing the most complex structure, the highest degree of differentiation or specialization found among fungi. Color, odor, and mucilaginous spore-mass have reference doubtless all to insect aid or agency in the dispersal of the spores. In this respect therefore these fungi stand related to most others as the entomophilous flowers to those which are anemophilous, and exhibit correspondent economy in the production of reproductive cells with more abundant outlay in other directions.[1]

Our species are all included under two genera—

Pileus attached to the receptacle at the apex only. . .	I. PHALLUS.
Pileus wholly adnate to the top of the receptacle. . .	II. MUTINUS.

I. PHALLUS.

Receptacle spongy, cylindric, the pileus attached to the receptacle at the apex only and bearing the gleba; gleba dark or olive-green in color, the spores elliptic.

KEY TO THE SPECIES OF PHALLUS.

A. Receptacle bearing an indusium or veil.	
a. Apex bare and perforate.	1. P. DÆMONUM.
b. Apex imperforate.	2. P. DUPLICATUS.
B. Receptacle without indusium or veil. . . .	3. P. IMPUDICUS.

1. PHALLUS DÆMONUM *Rumphius.*

Volva just at the surface of the ground, irregularly lacerate, its segments inflexed or erect; receptacle when fully expanded, 6–10 inches long, erect, white, loosely cellular, one inch to an inch and a quarter in diameter, perforate and annulate at the apex; indusium white, coarsely reticulate, dependent but a short distance; pileus campanulate, short; gleba at first smooth dark green or black, at length reticulately pitted, spores transparent, colorless, elliptic $2 \times 4\ \mu$.

This is our common species; not abundant, but with us from midsummer to October every year. Sometimes solitary, it is generally pretty closely gregarious, six or eight sporocarps coming sometimes to light within a very narrow area. It comes to fruit often under board walks, steps, and in similar inacessible localities, where it speedily makes its presence felt to the annoyance of a household or whole neighborhood. Carrion-flies assail the gleba, no sooner it is expanded, and sometimes seem to denude the pileus in very short time. May not *Phallus ravenellii* be a phase of this species? We often find specimens in which the veil simply emerges below the pileus, and the perforation is much more marked in some specimens than in others. At least, we have otherwise failed to identify the last named species in this locality.

---

[1] Nothwithstanding the unpleasant odor, it is hoped that persons who may discover specimens of this group will take pains to preserve them and transmit them to the University. The interest attaching to all species is great and there can be small doubt that the number of Iowa species is really much greater than would appear from our present list.

2. PHALLUS DUPLICATUS *Bosc.*

In all respects like the preceding except that the pileus is more conical, generally closed at apex, and is without the naked apical annulus; the indusium long and laciniate, extending beyond the middle of the stipe or receptacle, plicate; spores elliptic $2 \times 4\ \mu$.

Less common than the preceding species, similar to it but smaller and probably distinct. Found occasionally in the borders of woodlands, hazel-thickets, etc., and pungently odorous.

3. PHALLUS IMPUDICUS *Linn.*

Volva as in the preceding, the segments usually fewer, two or three; the receptacle white or yellowish, destitute of indusium; pileus with gleba conic-campanulate, at first closed at the apex, later perforate, spore-mass greenish or brownish, spores translucent $2 \times 4\ \mu$.

Rare. Smaller than the preceding, usually 4–5 inches high when expanded and proportionately slender. Occasionally met with in umbrageous woods where leaves accumulate from year to year. The odor characteristically pungent.

II. MUTINUS.

Volva thin, ruptured irregularly; receptacle stipe-like, but without a definite pileus; the gleba adnate directly to the summit of the receptacle.

KEY TO THE SPECIES OF MUTINUS.

A. Stipe thickest below.	1. M. BOVINUS.
B. Stipe thickest above.	
a. Sporiferous apex acute, inodorous.	2. M. CANINUS.
b. Sporiferous apex blunt, odorous.	3. M. BREVIS.

1. MUTINUS BOVINUS *Morgan.*

Volva oblong-ovoid. pinkish: segments two or three: stipe cylindric tapering to the apex. white or pinkish below. bright red above: apex conic-acuminate. perforate: spores 4 or 5×2 μ.

This remarkable species occurs. rarely indeed, but constantly in all the eastern part of the State. It has been collected many times but only a single specimen at a time in May or June. It rises as a bright red sharp-pointed pillar out of the grass in pastures or woods and soon to the distance of several rods proclaims its emergence. The apex is covered by the jelly-like spore-mass which does not seem to flow down readily and rather dries up and turns brown or black if not removed by insects. About six inches in height. Figured by the author of the species. *Cin. Soc. Nat. Hist. Journal.* January, 1889.

2. MUTINUS CANINUS (*Huds.*) *Fries.*

Volva ovoid. opening irregularly. segments two or three: receptacle long. slender. tapering downward. white or pink, the apex a little darker. acute. at first imperforate. later perforate or imperforate; spores 4×5 μ.

Very rare. One specimen from Johnson county so far is the extent of our collecting. Much smaller and more slender than the preceding and almost entirely without odor. Fig. 173, *Grevillea*, Vol. 17.

3. MUTINUS BREVIS *B. & C.*

Volva as in the preceding: receptacle dull red. tapering downwards, small. about four lines thick and two or three inches high; the spore-bearing apex blunt or clavate, livid, becoming black when dry; spores sometimes spherical 3 u, or elongate $2 \times 5\ \mu$.

Apparently rare. Seldom collected, more often reported. Small objects as they are, they are possibly even more pungently odoriferous than any of the rest. They seem to rise in colonies in fields and gardens, even in cellars! Some specimens before us are not more than an inch high.

NEW SPECIES OF TROPICAL FUNGI.

BY J. B. ELLIS AND B. M. EVERHART.

1. CONIOSPORIUM SUBSERIATUM *E. & E.*

Acervuli erumpent, subhysteriiform, 1–2 mm. long, subconfluent-seriate, black. Conidia globose-elliptical, brown, about 5×3–3½ μ, abundant.

C. L. Smith. On bark, Castillo, Nicaragua, February, 1893.

2. UREDO CUTICULOSA *E. & E.*

Sori gregarious, thin, pale flesh-color, ½–2 mm. diam., surrounded by the thin white epidermis, soon confluent, forming a thin, light, flesh-colored stratum elliptical in outline and ½–1 cm. in the longer diam. Spores globose, 15–20 μ, or obovate, 18–23×15–20 μ, with a thick, hyaline epispore, coarsely tuberculose above, becoming smooth below.

A very well marked and curious species.

An uredo badly infecting the pods of a species of Bignonia at Ometepec, Nicaragua. I am not aware that this species of Bignonia has any economic value. *C. L. S.*

Collected in January, 1893.

3. THELEPHORA SUBLILACINA *E. & E.*

Orbicular, 2–4 mm. diam., dirty lilac-color. Hymenium thin, fragmentary around the margin, supported on numerous erect, dark colored, pedicel-like fibers as in *T. pedicellata* Schw. These fibers arise from a round, dark colored, membranaceous, scale-like subiculum, 2–3 mm. diam., adnate to the bark, or with the margin partially free. Each of these erect fibers soon develops at its summit a small, light colored horizontal membrane, and these becoming confluent form the hymenium. Possibly this should be considered a mere var. of *T. pedicellata* Schw.

On small live twigs. Collected at Castillo, Nicaragua, 1893.

4. HEXAGONIA VITTATA *Ellis & Macbride.*

Pileus membranaceo-coriaceous, expanded, 2–3 cm. wide, 6–10 cm. long, subresupinate, the margin free and more or less reflexed, somewhat sulcate-plicate, thin, undulate, acute above, concentrically vittate, almost glabrous, black, the edge paler and sterile for only a very short distance; the alveoli pallid brown or fuscous, sometimes when young bluish or ashen, lustrous, the walls rigid, acute, the margins entire 500–700μ in diameter, somewhat irregular or elongate.

On the lower surface of fallen stems and branches of deciduous trees, Castillo, Nicaragua. C. L. Smith, 1893.

Judging by description of the compared species, *H. vittata* would seem near *H. carbonaria* B. & C. but differs in its free margin. From *H. friesiana* Speg. the present species seems to differ in being never dimidiate and in the peculiar, vittate, upturned margin. A very beautiful species. Like a Poria; but its dry rigid dissepiments, large and comparatively regular alveoli would seem to justify reference rather to the genus *Hexagonia.*

5. POLYPORUS OBOLUS *Ellis & Macbride.*

Pileus fleshy, soft, white or pallid, glabrous, thin delicate, wrinkled, and with repand margin when dry; above plane or only slightly convex, in diam. 2 cm. or less; stipe cartilaginous, delicate, slender, even or slightly enlarged at base, brown, translucent, 1–3 cm. in length, 2–3 mm. in thickness; pores minute, scarcely visible to the naked eye, round, not decurrent, white, the dissepiments thick and obtuse.

An extremely delicate and beautiful little species, distinguished by its delicate waxen non-umbilicate pileus, as by its graceful, slender, corneous stipe. Most of the specimens are very small, about 1 cm. in diameter, the stipe about the same length.

6. PEZIZA (SARCOSCYPHA) STRIISPORA *E. & E.*

Stipitate, thin, cup-shaped, 4–6 mm. across (10 mm. when pressed out flat), yellow outside and clothed with scattering, brownish, continuous hairs 1–1½ mm. long and 35–40 μ thick at base, tapering above, composed of compacted, parallel fibers. Hymenium pale orange. Asci cylindrical, sessile, 120–130×15 μ. Paraphyses filiform, branched above, tips slightly swollen. Sporidia oblong-elliptical, uniseriate (end to end), hyaline, 22–27×12 μ, ends subacute, endochrome constricted in the middle and faintly uniseptate, distinctly longitudinally striate. Stipe cylindrical, subequal, about 5 mm. long, ½ mm. thick.

Much resembles *P. floccosa* Schw. but differs in the structure of the hairs and the larger striate sporidia.

On decaying wood, Castillo, Nicaragua.

7. KARSTENIA SUBLILACINA *E. & E.*

Ascomata 2–4 mm. diam., flat, thin, of a light glaucous lilac color, at first enclosed and covered by a thin, light colored, membranaceous veil, soon erumpent and bordered by the remains of the ruptured veil and the lobes of the ruptured epidermis. Asci clavate-ellipsoid, subsessile, 110–120×25–30 μ. Paraphyses abundant, simple, longer than the asci, bearing above a layer of yellowish subglobose conidia 4 μ in diameter. Sporidia conglobate, fasciculate, vermicular-fusoid, hyaline, 75–35 μ long, subundulate or slightly curved, about 12 μ thick in the middle, tapering to each end, with 15–24 elliptical nuclei lying transversely.

On the green bark of a small tree at Castillo, Nicaragua.

8. HYPOCREA CUBISPORA *Ell. & Holway. Journ. Mycol. I, p. 4.*

Specimens collected by Mr. C. L. Smith, No. 5, Indian River, Nicaragua, March, 1896, have the stromata smaller (1½–4 mm. diam.) and flatter, and seated on a thin crustose-tomentose, lemon-yellow subiculum. Asci 65–75×4 μ cylindrical, paraphysate. Sporidia oblong, composed of 2 pale brown, oblong-ellipitical cells not very readily separating, constricted between the cells, 7–9×3 μ. Occasionally the cells are subcubical. Contents of the mature perithecia black. This differs from the Iowa specimens in the presence of a subiculum, smaller, flatter stromata, and rather larger sporidia, but can hardly be distinct. The Iowa specimens were not fully matured.

9. SCHIZOSTOMA STUPEUM *E. & E.*

Perithecia gregarious, ovate-conical, ¾ mm. high, ½ mm. thick, erumpent-superficial, brown, attached to the matrix by radiating, straight, tow-colored hairs; ostiolum thick, stout, short-cylindrical, obtuse, scarcely compressed, or with a short, narrow, erumpent, compressed beak, the black tip rising from the subtruncate apex; asci cylindrical, 75–85×4 μ, paraphysate, 8-spored; sporidia uniseriate, oblong, brown, uniseptate and slightly constricted, straight or very slightly curved, 9–12×3–3½ μ.

On rotten wood, Black Water River, Nicaragua; March, 1896. (C. L. Smith, No. 6.)

10. NECTRIA CHÆTOSTROMA *Ell. & Macb.*

Perithecia cespitose, globose, ⅓ mm. in diam., glabrous, dull red, becoming reddish brown, collapsing above, surrounded by a subiculum of brown, septate, crooked hairs 100–200 μ long and about 3 μ thick; ostiolum distinctly papilliform; asci clavate-cylindrical, 50–60×8–10 μ, subsessile, paraphysate, 8-spored; sporidia biseriate, oblong, slightly curved, 2-nucleate, constricted-uniseptate, pale brown, obtuse, 13–16×5–5½ μ. The first appearance is a tuft of dark brown hairs, which are finally hidden and almost obliterated by the densely crowded perithecia 10–40 in number in a compact group 1–4 mm. across.

On bark of some undetermined shrub or tree, Ometepec, Nicaragua.

11. KRETZSCHMERIA SPINIFERA *Ell. & Macb.*

Stromata oblong-ovate, 3–6 mm. in diam., and 4–6 mm. high, superficial, crowded and subangular from mutual pressure but not confluent, rough, black, carboraceous, rounded above, bearing considerable resemblance to the stromata of *Hypoxylon cohærens.*

Perithecia 1–3 in a stroma, large (1½ mm.), globose; ostiola at first strongly papillose, soon prolonged to short-cylindrical; asci not seen; sporidia broad, navicular-fusoid, continuous, opaque, compressed, 25–35×10–12 μ and 6–8 μ thick; viewed edgewise mostly narrowed in the middle.

Resembles *K. cœnopus* Mont., but differs in its prolonged ostiola and larger sporidia. The stromata also are sessile and connected at base by a slight stromatic crust.

On decaying bark. Mexico. (C. L. Smith.)

12. DIATRYPE TRIFIDA *Ell. & Macb.*

Stroma placoid, 2½–3 cm. across and 2½–3 mm. thick, of tough, hard, carbonaceous texture, not projecting much above the surface of the wood, bearing the oblong-ovate 1×½ mm. perithecia closely packed in a single superficial layer and covered by a thin, black, carbonaceous sheet, pierced and roughened by the projecting, short, conic-cylindrical, rough ostiola. The perithecia rest on a dirty yellowish, grumous layer about ½ mm. thick and subtended by a thin, hard, black, carbonaceous layer joined at the edges to the superficial sheet and prolonged below, in the central part, into a short, hollow stem (elliptical in outline on a cross section), and 2–3 mm. long, the cavity filled with a substance of the rotten wood into which it penetrates. Asci (p. sp.) 15–20×3–3½ μ, with a filiform stipe. Sporidia partly biseriate allantoid, hyaline (with a yellowish tinge), 3×1 μ. Has the outward characters of *Hypoxylon.*

On rotten wood. Tehuantepec, Mexico. (C. L. Smith.)

13. HYPOXYLON FIBULIFORME *E. & E.*

Stroma lenticular or button-shaped 2–5 mm. in diam., black, sessile, roughened by the papilliform ostiola. Perithecia elongated, subcylindrical, 1–1¼ × ⅓ mm., penetrating nearly to the bottom of the stroma; asci cylindrical, (p. sp.) $60 \times 5\,\mu$; sporidia elliptical, brown, uniseriate, $6–7 \times 3–3½\,\mu$.

On dead wood. Indian River, Nicaragua, March, 1896. (C. L. Smith. No. 12.)

14. HYPOXYLON LUCIDUM *E. & E.*

Effused, subpulvinate, 2 or more cm. long, 1½ cm. broad, black, surface shining as if varnished. Perithecia oblong-cylindrical, 1½ mm. long, ¾ mm. broad, closely packed, the conic-hemispherical, subsulcate ostiola roughening the surface of the stroma; asci cylindrical, short-stipitate, paraphysate, $75–85 \times 7–8\,\mu$, 8-spored; sporidia obliquely uniseriate, semiequilaterally oblong-elliptical, becoming opaque, $12–14 \times 6–7\,\mu$. Differs from *H. vernicosum* E. & E. in its larger sporidia and different ostiola, and also quite distinct from *H. lucidulum* Mont.

On dead wood. Nicaragua. (C. L. Smith.)

THE NICARAGUAN MYXOMYCETES.

WITH NOTES ON CERTAIN MEXICAN SPECIES.

(CONTINUED.)

BY THOS. H. MACBRIDE AND C. L. SMITH.

THE following list is based upon collections made during the year 1893–6 by Mr. Charles L. Smith acting for the State University of Iowa The list may be regarded as supplementary to that of Vol. II, p. 377. Some species are repeated here for the sake of showing distribution.

In reference to localities named it may be premised that Cerro de San Felipe is in Oaxaca, Mexico, and Indian River is the name of a small stream discharging into the Gulf of Mexico near Greytown, Nicaragua.

CERATIOMYXA MUCIDA *Pers.*
Indian River, and Momotombo, Nicaragua.

TUBULINA STIPITATA *Rost.*
Momotombo, Nicaragua.

ARCYRIA CINEREA (*Bull.*) *Schum.*
Not rare along the Indian River, Nicaragua.

ARCYRIA PUNICEA (*Bull.*) *Pers.*
Plentiful; Indian River and Momotombo, Nicaragua, and Jalapa, Mexico.

ARCYRIA DIGITATA (*Schw.*) *Rost.*
Collected but once; Indian River, Nicaragua.

LYCOGALA EPIDENDRUM *Buxb.*
Cerro de San Felipe, Mexico, and Momotombo, Nicaragua.

LYCOGALA CONICUM *Pers.*
A few specimens from Indian River.

TRICHIA FALLAX *Pers.*
Cerro de San Felipe, Mexico.

TRICHIA CHRYSOSPERMA (*Bull.*) *Pers.*
Cerro de San Felipe, Mexico.

TRICHIA VERRUCOSA *Berk.*
Cerro de San Felipe, Mexico.

HEMIARCYRIA RUBIFORMIS *Pers.*
Jalapa, Mexico.

Fine specimens of the botryoid form from Indian River, Nicaragua.

HEMIARCYRIA CLAVATA *Pers.*
Indian River, Nicaragua.

HEMIARCYRIA CLAVATA *Pers.* var. PLUMOSA *Morg.*
Jalapa, Mexico.

HEMIARCYRIA SERPULA *Scopoli.*
Indian River, Nicaragua, and Cerro de San Felipe, Mexico.

COMATRICHA TYPHINA (*Pers.*) *Rost.*
Jalapa and Indian River.

COMATRICHA PULCHELLA *Bab.*
Cerro de San Felipe, December, 1894.

STEMONITIS MAXIMA *Schw.*
Young specimens from Indian River.

STEMONITIS SMITHII *Macb.*
Jalapa, Mexico; Momotombo and Indian River, Nicaragua.

DIDYMIUM PROXIMUM *B. & C.*
On a banana peel; Greytown, Nicaragua.

DIDYMIUM SQUAMULOSUM (*Alb. & Schw.*) *Fr.*
On the living leaves and small stems of a piperaceous plant; Greytown, Nicaragua.

PHYSARELLA MIRABILIS *Peck.*
Some beautiful specimens from Indian River.

TILMADOCHE COMPACTA *Wing.*
Indian River and Momotombo, Nicaragua.

PHYSARUM GALBEUM *Wing.*
Indian River, Nicaragua.

PHYSARUM LEUCOPHÆUM *Fr.* var. VIOLACEUM *Rost.* (?)
Cerro de San Felipe, Mexico.

FULIGO VARIANS *Somm.*
One specimen from Jalapa, Mexico.

REPORT ON THE FISHES COLLECTED BY THE BAHAMA EXPEDITION, OF THE STATE UNIVERSITY OF IOWA, UNDER PROFESSOR C. C. NUTTING IN 1893.

BY PROFESSOR S. GARMAN.

MUSEUM OF COMPARATIVE ZOÖLOGY AT CAMBRIDGE, MASSACHUSETTS.

THERE are representatives of sixty-five species of fifty-three genera, in this collection. Five of the species are described as new. The great majority of the individuals are small; many of them are so young as to make it evident that the spawning beds are not far from the places of capture. Much the larger number of the species are such as frequent the shoal waters near the shores, or such as habitually remain near the surface in the open sea. The few, of genera like Chaunax, Halieutichthys, Phycis, Leptophidium, and Monolene, to which the terms deep sea fishes may be applied bear indications that their haunts were not beyond the reach of the effects of sunlight, but rather that they dwelt in an intermediate zone at the edge of complete darkness, in a twilight belt of which a more thorough knowledge is one of the great desiderata in marine science. There is a general interest attaching to this region in connection with our oceanic food supplies, but, beyond that, specialists in various departments eagerly await any addition to knowledge of conditions inside the borders of the shadowy zone through which sunlight is not supposed to reach. The warmth of their desire for such information will be more readily appreciated when it is understood that they have great hope that by means of efforts within its limits, toward the determination of the structure, of the affinities, of the daily and periodical migrations, or in other words of the life histories of its inhabitants, they will be able to solve questions connected with the origin, relationship, modification and habits of denizens of the regions farthest removed from sunlight in the greatest of the depths.

The present collection includes few duplicates for comparisons, and the number of deep-sea types is hardly sufficient for purposes of generalization; yet what were secured, locating by inference the feeding places of multitudes of other forms usually found in their company, would at once establish the importance of research in the localities from which they were obtained. Beside the comparatively large number of the better known fishes, the expedition was fortunate in being able to secure a number of new and rare species, especially so since the waters had already been pretty thoroughly traversed by ichthyologists. Determination of the species has necessitated frequent comparisons with types collected by the Cuban naturalist, Poey, around his island, types first made known by descriptions in his great works on the natural history of Cuba. In passing it may be mentioned that in repeated instances during the preparation of this report the specimens have borne most favorable testimony to the excellence of Professor Poey's contributions to ichthyological literature.

While all the parties interested in the expedition are to be heartily congratulated upon its success, consideration of the importance of what it has brought to light, and of what is yet remaining, occasions sincere regret that it was not blessed with a great deal more time and with more numerous and more convenient appliances. The following is the list of the fishes submitted for examination.

EPINEPHELUS GUATIVERE.

Serranus guativere Cuv., Val., 1828, Hist. Nat. Poiss., II, 383.

Young specimens. With ten or eleven small spots of black scattered over the sides of the head behind the eyes, otherwise uniform reddish brown. This fish is not to be identified with Linné's *Perca punctata;* that species was based on Catesby's plate 7, figure 1, which has fifteen dorsal spines and is closely sprinkled with small spots of blue over head and body. *E. guativere* is closely allied to *E. ouatalibi* of Cuvier and Valenciennes.

Tortugas, Florida.

POMADASYS BILINEATUS.

Pristipoma bilineatum C. V., 1830, v, 271.

On some of the young of this species the median band, that on the lateral line, is quite as distinct as that through the eye. Possibly this is common on specimens of an inch or less in length.

Tortugas.

HÆMULON SCIURUS.

Sparus sciurus Shaw, 1803, Gen. Zoöl., IV, 439, pl. 64.

Tortugas.

HÆMULON PLUMIERII.

Labrus plumierii La Cépède, 1802, Hist. Poiss., III, 480, pl. 3, f. 2.

Tortugas.

HÆMULON CANNA C. V., 1830, v, 253.

Tortugas.

GERRES CINEREUS.

Mugil cinereus Walb., 1792, Art. Pisc., 228.

Spanish Wells.

AMIA PUNCTICULATA.

Apogonichthys puncticulatus Poey, 1868, Rep. Fish. Nat. Cuba, II, 233.

Living specimens are probably red. In alcohol the appearance is very light, more or less blackish toward the outer portions of the fins. In cases darker centres on the scales form longitudinal vittæ. Ventrals long, blackish. One individual of the collection is very light in the ground color and has black puncticulations, with light centres, on the sides, among which are scattered small blotches of brownish; its fins have black tips.

Spanish Wells and Tortugas.

HOLACANTHUS CILIARIS.

Chætodon ciliaris Linné, 1758, S. N., I, 276.

Tortugas.

POMACANTHUS ARCUATUS.

Chætodon arcuatus Linn., 1758, S. N., I, 273.

Tortugas.

UPENEUS MACULATUS.

Mullus maculatus Bloch, 1793, Ausl. Fische, VII, 95, pl. 348, fig. 1.

Tortugas.

SCORPÆNA DACTYLOPTERA De la Roche, 1809, Ann. Mus., XIII, pl. 22, f. 2.

From European specimens Dr. Günther gives this species twenty-four vertebræ; each of two individuals in this collection has twenty-five. The occipital excavation and the suborbital spines are hardly noticeable, and the general appearance approaches that of Sebastes.

Taken in 105 fathoms, six miles S. ½ E. of Sand Key Light, Station 33.

SCORPÆNA PLUMIERII Bloch, Schneider, 1801, Syst. Ichth., 194.

Off Key West, in 60 fathoms.

HOLOCENTRUS CORUSCUS Poey, 1860, Mem., II, 158.

This species is somewhat close to *H. longipinne* C. V. in form and proportions, but is distinguished by the smaller number of fin rays and the black spot on the first dorsal. It is intermediate between that species and *H. vexillarius* Poey, being more elongate than the latter. The Museum of Comparative Zoölogy has specimens from the Bahamas.

Spanish Wells.

HEPATUS HEPATUS.

Teuthis hepatus Linn., 1766, S. N., 507.
Spanish Wells.

CARANX FALLAX C. V., 1833, IX, 95.

Young specimens, with four to six vertical bands, much affected by a wormlike parasite which attaches itself in much the same manner as a myxinoid fish.

Tortugas.

CARANX HIPPOS.

Scomber hippos Linn., 1766, S. N., 494.
Tortugas.

CARANX BARTHOLOMÆI C. V., 1833, IX, 100.

Tortugas.

CARANX RUBER.

Scomber ruber Bloch, 1793, Ausl. Fische, pt. 7, p. 75, pl. 342.
Spanish Wells.

SERIOLA LALANDI C. V., 1833, IX, 208.

In shape and proportions young of this species bear resemblance to *S. fasciata* of Bloch. *S. lalandi* is readily distinguished by the length of the maxillary, which quite reaches a vertical through the middle of the eye, and by the different arrangement of the transverse bands. The bands are rather faint. That from the nape to the eye is moderately distinct. On the body there are five pairs; the first, hardly separated, passes from the nape across the bases of the pectorals; the second crosses from the space between the dorsals to the space between the ventrals and the vent; the third pair goes from the notch in the soft dorsal to the vent; the fourth is just back of the middle of the soft dorsal; and the fifth, the most faint, is at the end of the dorsal. The edges of the fins are darker. The back has a bluish iridescence.

Tortugas.

POMATOMUS SALTATRIX.

Gasterosteus saltatrix Linn., 1766, S. N., 491.
Very young. "From the stomach of a dolphin."
Florida Reefs.

CORYPHÆNA sp. ?, juv.

Off Key West, in 6 fathoms.

NOMEUS GRONOVII.

Gobius Gronovi, Gmel., 1788, Linn. S. N., 1, 1205.

Apparently these are common attendants on Physaliæ, as if for protection. On several occasions Physaliæ have been taken with partially digested Nomei in their grasp, which would indicate that the little fishes were sometimes preyed upon by the "men of war."

Tortugas.

ECHENEIS NAUCRATES Linn., 1758, S. N., 261.

Tortugas.

PORICHTHYS PLECTRODON J. & G., 1882, P. U. S. Mus., 291.

Above the silvery band on the flank there is a row of about nine large spots, as large as the eye or larger; above this row, at each side of the base of the dorsal, there is a second row of a dozen of smaller spots; and on the dorsal fin near its margin a third row of much smaller ones appears. The upper half of the head is thickly sprinkled with small spots. This maculation is a common pattern on specimens from the shoals of the West Indies and the Gulf of Mexico. The luminous organs are very distinct; they recall those of the Chauliodontidæ and the Sternoptychidæ.

PTEROPHRYNOIDES GIBBUS.

Lophius gibbus Mitch., 1815, Trans. Lit. Phil. Soc. N. Y., 1, pl. 4, f. 9.

The description and figure of *Lophius raninus* by Tilesius do not apply to these specimens. They bear some resemblance to *L. histrio* of Linné but differ markedly in certain respects. The bait on the first dorsal spine, for instance, is bulbous and covered with slender fleshy filaments in our individuals, but in *L. histrio* it is bifurcate. P. gibbus is fairly represented by Cuvier, 1817, in his *Chironectes lævigatus*. The formula, for the individuals at hand, is D. 3+12; A. 7; V. 5; P. 10; C. 9.

Tortugas; South of Key West Light, in six fathoms; Lat. 31° 30′ N., Long. 75° 11′ W., in Gulf Weed.

ANTENNARIUS OCELLATUS.

Lophius histrio var. *ocellatus* Bl. Schn., 1801, Syst. Ichth., 142.

A few items concerning this species are taken from museum specimens for purpose of comparison with the forms described below. The species was tolerably figured by Parra but has not been recognized by some of the subsequent writers. On five specimens before me the amount of variation in markings is comparatively small. The three large ocelli, on dorsal, caudal and middle of side, are present on each, as is also the case with the numerous small spots of black on the ventral portions of the body and on the outer portions of dorsal and caudal. The dorsal ocellus lies between the sixth and seventh rays, on the middle of the fin; that on the flank is situated above the vent; and that on the caudal between the fourth and fifth rays, from the top, near the middle of the fin. The black portion of either of these spots is larger than the orbit, which latter is rather small when contrasted with that of other species. The white circle around the black, again, is surrounded by a narrow one of brown. On the caudal, at each side of the ocellus, there are transverse streaks. The first ray of the dorsal is as long as the second, and is covered by scales. The bulb apparently is simple and bears numerous laciniæ. The second dorsal spine is shorter than the third; both are club-shaped. The space behind the second dorsal spine is covered by scales.

ANTENNARIUS MULTIOCELLATUS.

Chironectes multiocellatus C. V., 1837, XII, 420.

This species is distinguished by the trifid bulb and the long first dorsal ray, near twice as long as the second and quite as long as the caudal, by the high nape, by the large third dorsal ray, much larger and more swollen than the second, and by the coloration. The eye is very small. The black centres of the largest of the ocelli are smaller than the eye. Besides the ocellus on the soft dorsal that on the anal and the three forming a triangle on the caudal, there are others scattered over the caudal and other fins, and over the sides of the body. Below the eye on the cheek and under the chin and the chest the spots are little more than black dots. Over the sides a specimen in hand, the type of *A. corallinus* Poey, is freckled with lighter rounded spots. Behind the pectoral on the side there is a small ocellus with a black center. On each side in the same position, a short distance above the pectoral there is a brown ocellus, larger than the orbit, in the center of which there is a white dot. A brown streak passes back from the upper part of the orbit and curves down toward the anal ocellus; another passes back from the middle of the eye and curves down toward the pectoral; and a third below the third dorsal spine runs down and then forward toward the lower end of the maxillary. The forehead is comparatively narrow; behind the second dorsal ray the bare space is hardly large enough to receive the bait.

It may be stated here that the species *A. scaber* C. V. and *A. tigris* Poey are closely allied, but if placed side by side the squamation and filaments suffice to distinguish them, great similarity in color notwithstanding. *A. scaber* has coarser scales, with shorter, rougher spines and the scales are farther apart; and the cutaneous flaps appear on the body much as figured by Cuvier. On *A. tigris* there are few of the cutaneous appendages, the scales are closer together, the spines are longer and more slender, giving rise to an appearance more like velvet, and the head and body are more compressed.

ANTENNARIUS NUTTINGII sp. n. Plate II.

D. 3+12; A. 7; V. 5; P. 11; C. 9.

In form this species is shorter, more massive anteriorly, and less compressed than either *A. ocellatus* or *A. radiosus*. A transverse section across the middle of the body is a nearly equilateral triangle. Caudal region short. Head nearly as wide as high; cheeks swollen; forehead rather broad, converging forward on the edges. Occipital concavity wide and deep, free from scales in a large space below the ends of the first and second dorsal rays, this bare space being apparently for the reception of the fleshy bait bulb, which latter has two elongate lobes. Snout as long as the orbit, broad, truncate. Chin vertical; symphyseal knob prominent. Mouth wide, subvertical. Eye small; orbit twice as long, hardly more than half the interorbital space. First and second dorsal rays equal in length, not inclusive of the two elongate fleshy fringed lobes surmounting the first. The base of the first ray stands forward prominently over the mouth, being free for some distance. The greater portion of the second ray is free, while the third is connected with the dorsum, by the skin, from base nearly to tip. This last ray is larger than either of its fellows. Soft dorsal large; middle rays longest, as long as the distance from the maxillary to the hind edge of the operculum, or as long as the rays of the caudal fin; fin not reaching back to the bases of the caudal rays, fringed. Hind margin of caudal convex, fringed. Anal moderate, rays prominent in the margin, fin with a blunt angle on the outer edge, subtending, when laid up against the tail, one-fourth or more of the length of the caudal rays. The rays on the pectoral fins extend out beyond the margins more noticeably than those of the other fins. Ventrals small, in most instances with six points on the outer margin, in one case having but five. Greatest length of the caudal nearly one-fourth of the total length. Length of each maxillary two-thirds of the caudal. Scales short, small, close set, harsh to the touch, having none of the velvety appearance.

Uniform black; inside of mouth black; bait white.

Great Bahama Banks.

This species is readily separated from *A. principis* of authors by the short first dorsal spine. The specific name is given in honor of Professor C. C. Nutting, to whom science is so much indebted for the origination and successful accomplishment of the expedition. Besides the specimens in his collection there are several others in that of the Mus. Com. Zoöl.

ANTENNARIUS RADIOSUS sp. n. Plate I.

Antennarius sp. Nutting. 1895. Prelim. Rep., 149. pl. XIV, f. 2.

D. 3+13; A. 8; V. 5; P. 11; C. 9.

Resembling *A. tigris* Poey in shape, squamation, etc., but differing in coloration and in possession of a much longer first dorsal ray. The staff in this ray is very slender, much longer than the second ray, and bears a small trifid bait. Second and third dorsal rays shorter than the first, the third well tied down by the skin. Scales uniform, sharp. No cutaneous fringes, on large specimens.

Greyish or brownish white, darker on nape and dorsal fin, with numerous spots of light color, as large as the orbit, surrounded by more or less complete edgings of brown, producing a semblance to reticulation, or to spotting by drops of liquid. Seven streaks of brown radiate from the eye, as in *A. tigris*; they are continued upon the head and down toward the ventrals. A large spot of black, white edged, a little larger than the orbit, half on the fin and half on the muscles of the body, occupies the space between the eighth and the tenth rays of the soft dorsal fin. The light areas vary in intensity and lie close together over nearly the whole of body and fins. Belly lighter, with faint indications of lines of browish, radiating from the head. Caudal with oblique transverse cloudings of brownish: hindmost one-fourth light. The color in life was probably reddish or yellowish.

Secured off Key West, in about fifty fathoms.

A young individual, of less than an inch, taken opposite Havana is of lighter gray and has a large ocellus, of light color in the center, between the black one at the base of the dorsal and the upper end of the humerus. There are small cutaneous fringes on the flanks.

CHAUNAX NUTTINGII sp. n. Plate III, fig. 2.

B. 6; D. 2+13; A. 7; V. 4; P. 14; C. 9.

This is the specimen referred to by Professor Nutting in his preliminary report of the expedition (p. 149, pl. XIV, fig. 1) as "a strange pediculate fish." His artist overlooked the anal fin; otherwise the form resembles that of *Chaunax pictus*, but is shorter, broader, and possessed of more fin rays. Anteriorly it is broad and depressed, posteriorly compressed. From head to soft dorsal on the nape it is arched very little. Head broader than high, flattened or slightly concave on the occiput, nearly vertical on the chin. Snout short, broad, truncate. Eye medium; the length of the scale less area covering it equals the width of that between the canals on the interorbital space, or about two-thirds of the space itself; the distance from the maxillary is about the ocular width. The niche in which the first dorsal spine is received is subelliptical and about three-fourths as long as the eye; the tentacle is little more than half as long as the niche, is broad near the base, tapers rapidly, and bears a two-lobed bait with slender fringes. Mouth wide, oblique; maxillary about three times as long as the eye, widened and rounded at the outer end; intermaxillaries alone forming upper border of mouth. Teeth small, slender, sharp, in viliform bands. Origin of soft dorsal in the middle of the distance from the rostral tentacle to the base of the caudal fin, fourth ray above the gill opening, anterior rays shorter. Vent below the seventh ray of the second dorsal. Pectorals short, broad, rounded. The canals of the lateral system are in the main like those of *C. pictus*, but have stronger curves; they begin to curve outward immediately behind the niche, not remaining parallel or converging as in Lowe's species. Scales very fine, sharp and close together.

In life this fish was probably red or yellowish with transverse cloudings or blotches of brownish; it is now dingy brownish white. One of the blotches lies just behind the eye, another lies below the orbit, and apparently three transverse bands cross the back through the soft dorsal. Orbit blackish. Tentacular niche black. The coloration of the individual described indicates a habitat within reach of the effects of sunlight.

Nearly eight miles south of Sand Key Light; about 120 fathoms.

ONCOCEPHALUS VESPERTILIO.

Lophius vespertilio Linn., 1758, S. N., 236.

Snout one-sixth of the total length. Without brown bands or reticulations. Light colored.

Off Key West, south, in 60 fathoms.

ONCOCEPHALUS RADIATUS.

Lophius radiatus Mitch., 1818, Am. Month. Mag., II, 326.

Lophius (*Malthe*) *cubifrons* Rich., 1836, F. B. A., Fish., 103.

Great Bahama Banks.

HALIEUTICHTHYS ACULEATUS. Pl. IV, fig. 1.

Lophius reticulatus Mitch., 1818, Am. Month. Mag., II, 325.

D. 1+5; A. 4; V. 5; P. 17–18; C. 9.

As in Halicutæa, Dibranchus, and allies, a rostral tentacle is present in this genus. Among specimens belonging to the Museum of Comparative Zoölogy there is evidence of the existence of a couple of distinct forms in the West Indian waters. The true *H. aculeatus* is much the lighter in the ground colors and has brownish reticulations across the back. Two or three narrowish transverse bands of the same color cross the pectorals, and two or three similar bands appear on the caudal, the posterior being darkest. The margins of the fins are light in color. The rostrum is acute; it ends in a spine which turns upward; and seen from above, it is hardly long enough to cover the tentacular niche. Evidently this type belongs to the shallower waters. The localities noted carry its distribution from the Bahamas to the Yucatan Banks. in depths of forty fathoms and less.

HALIEUTICHTHYS CARIBBÆUS sp. n. Pl. IV, fig. 2.

D. 1+5; A. 4; V. 5; P. 17; C. 9.

This type is darker than the preceding; the reticulations are not present; the outer half of the pectoral, except at the margin, is black; and, excepting the narrow posterior margin, the hinder fifth of the caudal fin is black. The upper surface is clouded brownish without traces of the net-work pattern common to *H. aculeatus.* On the specimens described the rostrum is acute, and the spine extends forward to cover the cavity receiving the tentacle so that it is not visible on specimens viewed from above. As now known this species ranges from Jamaica to Barbados in depths of seventy to a hundred and fifty fathoms or more.

PRIONOTUS TRIBULUS C. V., 1829, IV, 98, pl. 74.

On specimens of less than an inch and a half the head is less than one-third of the total length, the pectoral reaches farther back than to the base of the anal but not quite as far backward as to the tip of the anal fin. The transverse bands are very distinct and reach across the entire flank. The tip of the caudal is dark, as also the spot at the base, and there is a fainter band across the middle of the fin. A light band between two darker ones crosses the interorbital space into the eye, giving the appearance in the latter of radiating bands or streaks of dark and light. From the eye a dark patch extends down upon the cheek; at each side of the symphysis, on both jaws, there is a small spot, and midway between it and the angle of the mouth there is another. The pectorals are blackish, with white upper margins; the spot on the dorsal is brownish.

Tortugas.

GOBIUS EIGENMANNI sp. n. Plate III, fig. 1.

D. 7+12; A. 13; P. 19; Ll. 27; Ltr. 7.

Body rather stout, body cavity more than half the length from snout to base of caudal. Head two-ninths of the total length or two-sevenths of the distance to the caudal base, blunt and rounded anteriorly, very narrow between the eyes, slightly compressed. Eyes large, one-third of the head, very close together. Snout short, little more than half as long as the eye. Mouth wide; maxillary reaching a vertical from the middle of the eye, moderately oblique. First dorsal higher, anterior three rays prolonged in the filaments, third ray longest and reaching to the eighth ray of the second dorsal. Origin of anal fin midway from edge of preopercle to base of caudal. Pectorals nearly as long as the head. Caudal as long as the head, pointed. Scales large, thin, deciduous, twenty seven in a longitudinal series, two rows above the lateral line.

Yellowish, with a few puncticulations of black near the bases of the caudal rays, with a light-edged black spot on the outer halves of the fourth to the sixth rays of the first dorsal, and with a black streak around the mouth immediately above the maxillary. The long body, the large eye, the dorsal spot, and the streak above the mouth serve to distinguish this species from its nearest allies of the same locality. The specific name is given in honor of the distinguished ichthyologists who have added so much to our knowledge of the American Gobiidæ, C. H. and R. S. Eigenmann.

Off Key West, in 60 fathoms.

GOBIUS SOPORATOR C. V., 1837, XII, 56.

Spanish Wells.

BLENNIUS PILICORNIS C. V., 1836, XI, 254.

Small subhexagonal reticulations on each cheek present the appearance of scales. Anal fin darker toward ends of rays, which are white. Dorsal fin darker in the outer half. A few dots of black scattered along the sides. Basal portions of dorsal and anal light. Median rays of caudal longer; outer margins dark. Caudal, pectorals and ventrals lighter than the other fins.

Tortugas.

MYXODES MACROPUS Poey, 1868, Syn. Pisc. Cub., 399.

Tortugas.

ATHERINA STIPES M. & Tr., 1848, Schomb. Hist. Barbad., 671.

Tortugas.

GOBIESOX RUPESTRIS Poey, 1860, Mem. Cub., II, 283.

Egg Island.

POMACENTRUS LEUCOSTICTUS M. & Tr., 1848, Schomb. Barbad., 674.

Tortugas; Spanish Wells.

LACHNOLAIMUS MAXIMUS.

Labrus maximus Walb., 1792, Art. Gen. Pisc., 261.

Young individuals of less than two inches differ so much from the adult as to be hardly recognizable. The anterior rays of the dorsal are little longer than those back of them; the filaments extend little if any beyond the points of the spines; the outer rays of the caudal are not elongate; the rays of soft dorsal and of anal have not developed into sharp angles on those fins; there are a couple of silvery spots below the eye; and there are vertical narrow bands of brownish separated or edged by white or silvery on the flanks. The anterior of these bands passes from the anterior rays of the dorsal to the bases of the ventrals; two fainter ones farther back pass down from the spinous dorsal; and a more distinct one runs from the soft dorsal to the anal fin. Behind this last on both dorsal and anal there are two dark spots the inner of which rests on the base of the hindmost rays. The caudal is marked around the edges with dark.

Tortugas.

PLATYGLOSSUS BIVITTATUS.

Labrus bivittatus Bloch., 1791, Ausl. Fische, v, 133, pl. 284, f. 1.

Tortugas.

PSEUDOSCARUS CŒRULEUS.

Coryphæna cærulea Bl., 1786, Ausl. Fische, II, 148, pl. 176.

Tortugas.

PHYCIS REGIUS.

Blennius regius Walb., 1792, Art. Gen. Pisc., 186.

About eight miles south of Sand Key Light; near 120 fathoms.

LEPTOPHIDIUM CERVINUM G. & B., 1885, P. U. S., Mus., VIII, 422.

Rufous with puncticulations of black, and with a series of eight to ten or more faint spots of light color, hardly as large as the eye, above the median line of the flank, from the upper angle of the opercle backward. Edges of vertical fins blackish.

Nearly eight miles south of Sand Key Light; about 120 fathoms.

FIERASFER DUBIUS Put., 1874, P. B. S. N. H., 344.

Tortugas.

PLATOPHRYS OCELLATUS.

Rhombus ocellatus Ag., 1829, Spix. Pisc., 85, pl. 46.

D. 76–83; A. 57–62; V. 6; P. 11 upper, 9 lower; Ll. 78; Ltr. 30.

Bahama Banks; Tortugas.

HEMIRHOMBUS ARAMACA.

Pleuronectes aramaca Cuv., 1829, R. An., II, 341.

The formula given this fish by Günther is D. 85; A. 65; Ll. 70. From some of these examples we find it to be about D. 81; A. 67; V. 6; P. upper 11, lower 9; Ll. 56; Ltr. 18+18.

Off Key West.

MONOLENE SESSILICAUDA Goode, 1880, P. U. S. Mus., 338.

D. 104; A. 84; V. 6; P. 11 upper, 0 lower; Ll. 93; Ltr. 22+24.

The description of the coloration given by Goode ("Color on the left side ashy brown, with numerous more or less distinct darker brown spots. On the blind side white. Pectoral blackish, with traces of lighter transverse bands,") applies to deep sea specimens. As if they had lived within reach of the light, in shoaler water, Professor Nutting's specimens are much more distinctly marked. They are greyish brown, with numerous spots of darker to blackish over head and body, the spots being half as large as the eye or smaller, arranged in greater part in broad transverse bands, as wide as the interspaces, of which bands the foremost and narrowest passes from the nape to the opercle, the second lies immediately behind the pectoral, the third just in front and the fourth just behind the middle of the total length, and the fifth, more indistinct, crosses near the ends of dorsal and anal. The caudal is crossed by two rather indefinite narrow streaks. The pectoral is white at its base and bears three or four narrow curved transverse bands of white separating three or four similar bands of black, which, with the white, are more distinct in the lower half of the fin.

Off Key West.

Specimens from depths of 150 fathoms or more agree well with these in the formulæ and to some extent in marks, but not in the distinctness of the latter. The difference is evidently not due to age, since the sizes are the same. The caudal of the deep sea examples is light at the base and on the upper and lower margins, and blackish on the inner rays to the posterior extremity.

SYMPHURUS PLAGUSIA.

Pleuronectes plagusia Bl. Schn., 1801, Syst. Ichth., 162.

Off Key West, in about 20 fathoms.

SYNODUS INTERMEDIUS.

Saurus intermedius Ag., 1829, Spix. Pisc., 81, pl. 44.

Off Key West, in about 60 fathoms.

HEMIRHAMPHUS BALAO Les., 1821, J. Phil. Ac., II, 136.

Florida Reefs.

EXOCÆTUS OBTUSIROSTRIS Gthr., 1866, Cat., VI, 283.

"South of the Gulf Stream," off the Bahamas.

GYMNOTHORAX MORINGA.

Muræna moringa Cuv., 1829, R. An., II, 352.

Spanish Wells.

OPHICHTHYS sp., larva.
Bahama Bank.

SPHAGEBRANCHUS SCUTICARIS G. & B., 1880, P. U. S. Mus., II, 343.
Off Key West, in about 100 fathoms.

SIPHOSTOMA ELUCENS.
Syngnathus elucens Poey, 1868, Rep., 443.
Tortugas.

HIPPOCAMPUS PUNCTULATUS Guich., 1855, Pec. Cub., 239, pl. 5, f. 2.
Off Key West in 20 to 60 fathoms.

BALISTES BUNIVA La C., 1803, v, 669, pl. 21, f. 1.
D. 3+34; A. 30; P. 15; Ll. 64; Ltr. 30.
Spanish Wells.

BALISTES FULIGINOSUS DeK., 1842, N. Y. Fish., 339, pl. 57, f. 188.
D. 3+28; A. 27; P. 13; Ll. 40; Ltr. 17.
Lat. 31° 30′ N.; Lon. 75° 11′ W. in Gulf Weed.

BALISTES MACULATUS Gmel., 1789, Linn. S. N., I, 1468.
D. 3+23; A. 20; P. 14; Ll. 50; Ltr. 36.
Lat 31° 30′ N.; Lon. 75° 11′ W., in Gulf Weed.

MONACANTHUS HISPIDUS Linn., 1766, S. N., I, 405.
Great Bahama Bank; off Key West.

TETRODON TURGIDUS Mitch., 1815, Tr. Lit. & Phil. Soc. N. Y., I, 473, pl. 6, f. 5.
Spanish Wells.

TETRODON SPENGLERI Bloch, 1785, Ausl. Fische, I, 135, pl. 144.

DIODON HYSTRIX Linn., 1758, S. N., I, 335.
Lat. 31° 30′ N.; Lon. 75° 11′ W., in Gulf Weed.

DROMICUS ANGULIFER Bibron, 1843, Rept. Cuba, 222, pl. 27.

In one of the jars of fishes there is a small snake with the legend "Key West, in the Schooner." Very likely the specimen was taken on board while the vessel was off the coast of Cuba as it is abundant on that island.

A NICARAGUAN SHELL-BANK.

BY B. SHIMEK.

THE peculiar exposure of which notice is here made is found on the Manuel Vargas ranch, east of San Carlos, Nicaragua, on the south bank of the San Juan River. The river, here only twelve miles from the outlet of Lake Nicaragua, flows due east and cuts into a terrace on the southern shore, forming a vertical bank which gradually rises from the low river-bottom at its eastern extremity, and reaches a height of more than fifteen feet at the western extremity of the shell-bearing portion. This bank, for one hundred yards from its eastern extremity, consists of fine alluvium which is literally packed with Unio shells, frequently cemented together by calcareous tufa into large masses.

The shell-bearing portion of the exposure averages about twelve feet in height, but the surface of the ground gradually rises back from the river, and shells were traced along the surface to a point more than one hundred and fifty feet from the shore, this point being fifteen or twenty feet above the river which had then (March 12th, 1892) not yet reached its lowest stage. This indicates a total thickness of the deposit of more than fifteen, and probably not less than twenty feet.

There are three species of *Unio* in the series of shells collected from the bank, and they are identical with living species found now in the mud of the river at the foot of the exposure. Many of the fossil shells still have their valves united by the ligament, and not a few are in a vertical position, showing that the shells had been deposited *in situ*. These species are now found living in abundance in the river in the mud close to the shores, and the fossil shells no doubt were developed under similar conditions.

The conclusion naturally follows that at one time the San Juan River and, of course, Lake Nicaragua, of which it is the outlet, had their low water mark more than fifteen feet above the present level; that the river has since cut through the eastern barriers to its present level, in its downward progress gradually depositing an oblique sheet of shell-bearing alluvium; and that the level of the lake has correspondingly fallen. Lake Nicaragua is to-day more than one hundred feet above sea-level. The San Juan River therefore has sufficient fall for further effective erosion, which is, without doubt, going on at an increasing rate, and the conclusion seems irresistible that the lake is destined to a further reduction of its level, and a still further contraction of its area, and that within no distant future; since it is evident from the comparatively perfect preservation of the shells above mentioned that the whole shell-bank is a very recent affair indeed, as terrestrial changes go.

In view of the attempted construction of vast public works along the valley of the San Juan River, the importance of this conclusion is sufficiently obvious.

While the lake cannot be wholly drained, its greatest depth being about two hundred and forty feet and the elevation of its surface above sea level being one hundred and ten feet, its average depth is such that a comparatively slight fall in its general level must cause a great contraction of its area,—a circumstance of much importance to the cities and towns along its shores.

The building of the proposed great Ochoa dam across the lower San Juan River in connection with the construction of the Nicaragua Canal is probably the only thing that would arrest this erosion, and would secure the retention of this vast and important inland reservoir of fresh water.

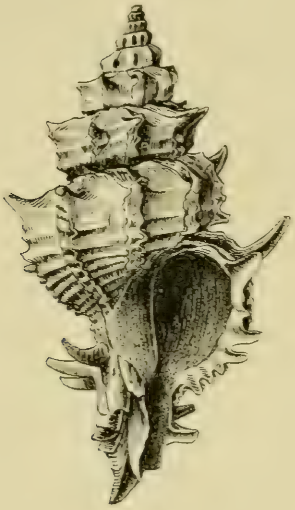
EXPLANATION OF PLATE.

FIG. 1. MUREX NUTTINGI *Dall* (drawn from specimen 107,372, U. S. Nat. Mus.) Height of shell 56 mm.; page 13.

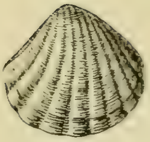
FIG. 2. CERION NITELOIDES *Dall* (drawn from specimen 107,411, U. S. Nat. Mus.); height of shell 28 mm.; page 15.

FIG. 3. LIOTIA CENTRIFUGA *Dall* drawn from specimen 107,419, U. S. Nat. Mus.); height of shell 3.5 mm.; page 16.

FIG. 4. CARDITELLA SMITHII *Dall* (drawn from specimen 107,365, U. S. Nat. Mus.) Height of specimen 2 mm.; page 16.

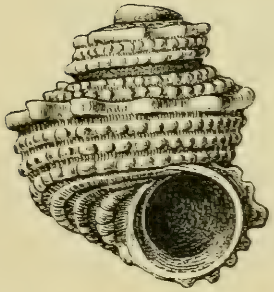


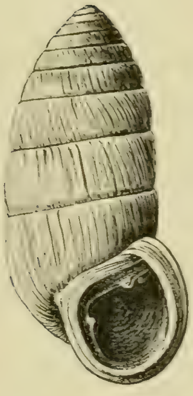
1



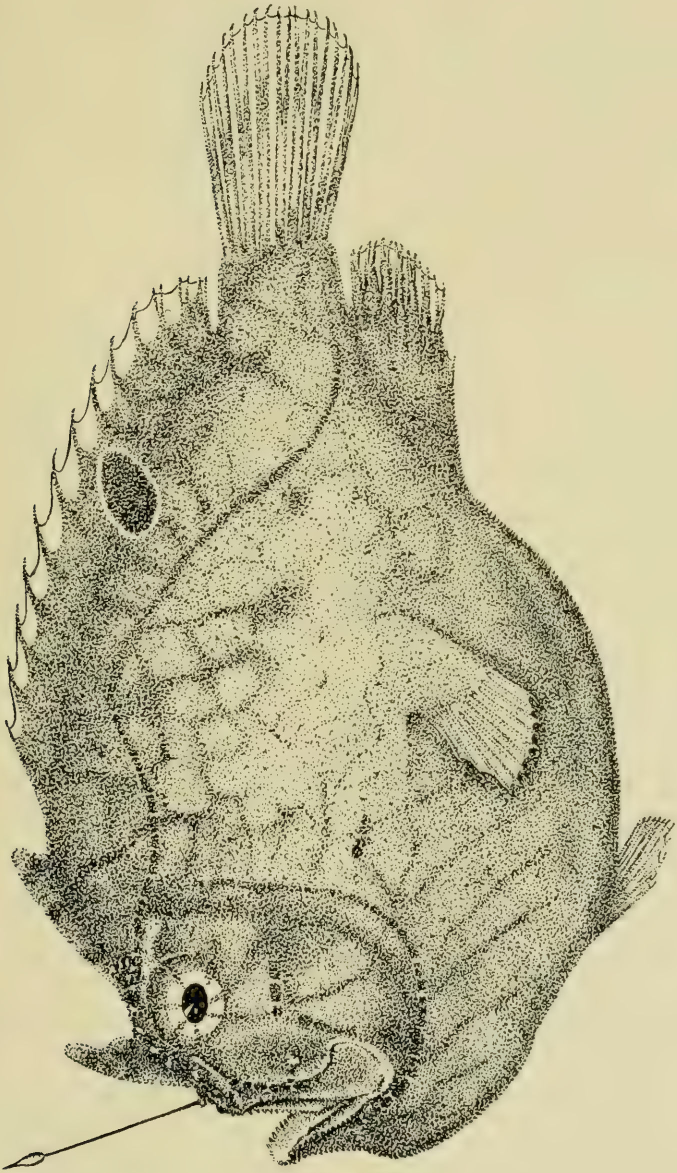
4

3



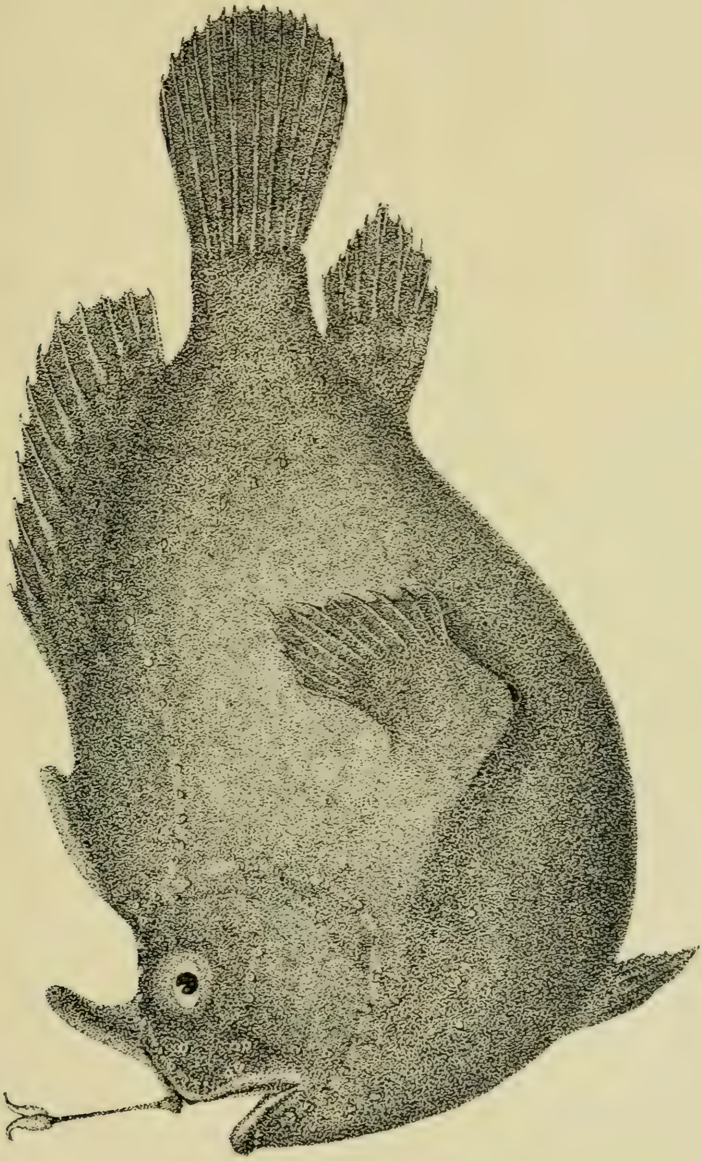


2



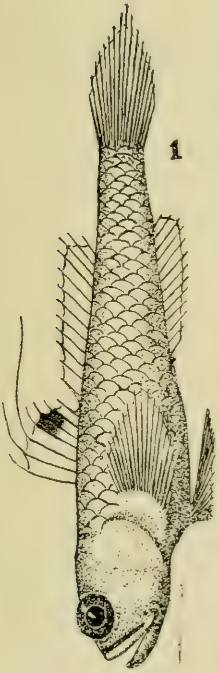
Antennarius radiosus *Garman.*

C. A. King, del.

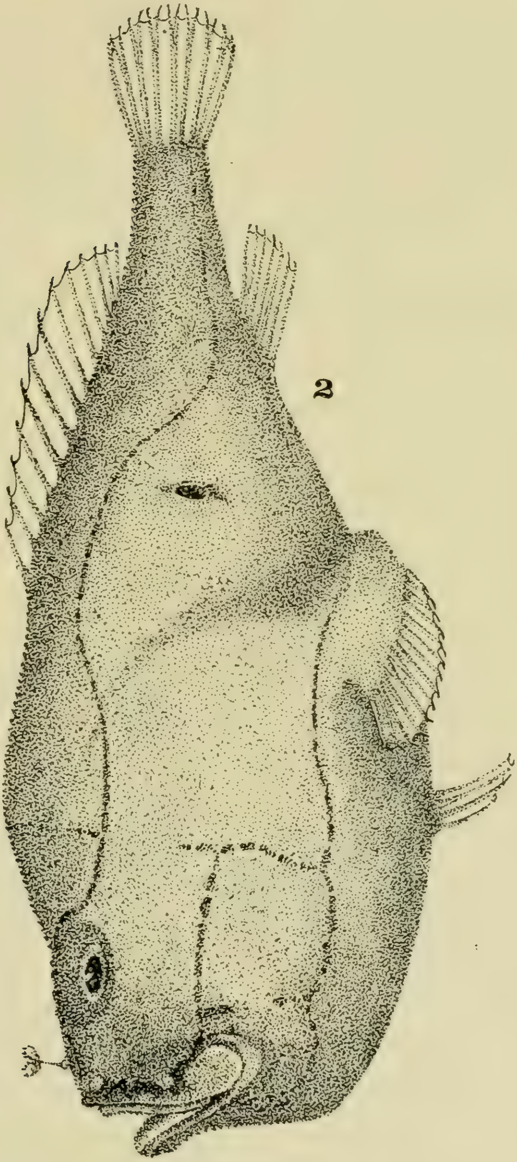


ANTENNARIUS NUTTINGII *Garman.*

C. A. KING, del.



1

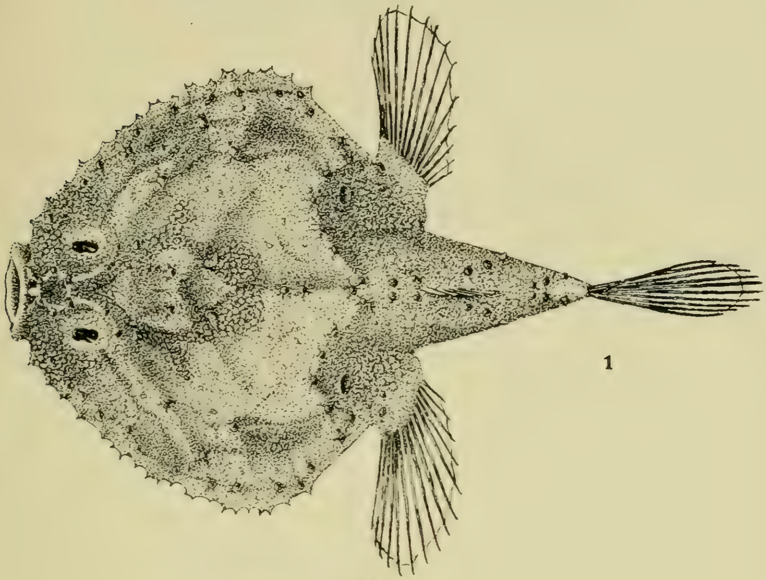


2

FIG. 1. GOBIUS EIGENMANNI *Garman.*

FIG. 2. CHAUNAX NUTTINGII *Garman.*

C. A. KING, del.



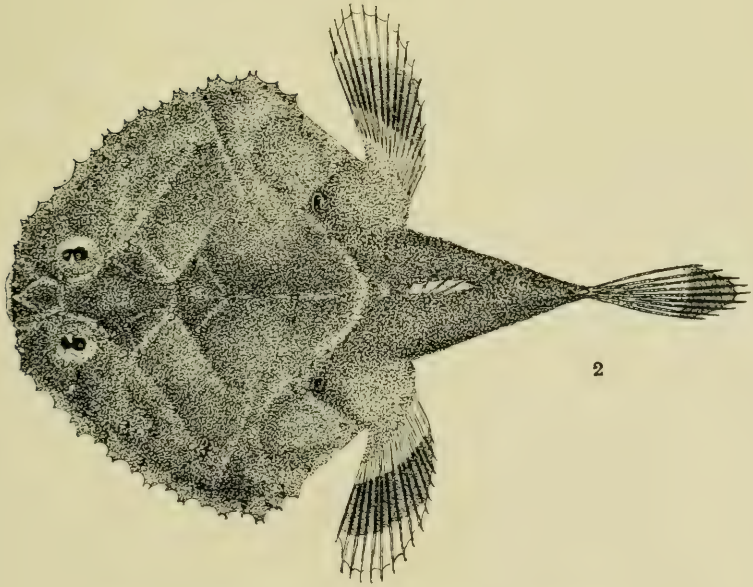


FIG. 1. HALIEUTICHTHYS ACULEATUS *Garman.*

FIG. 2. HALIEUTICHTHYS CARIBBÆUS *Garman.*

C. A. KING, del.

M. J. Reamer
from
T. H. Macbride

PRICE, FIFTY CENTS.

VOL. IV. NO. 2.

BULLETIN

FROM THE

LABORATORIES OF NATURAL HISTORY

OF THE

STATE UNIVERSITY OF IOWA.

I. THE COLEOPTERA OF THE LOWER RIO GRANDE VALLEY, ... H. F. WICKHAM.

II. THE FERNS OF NICARAGUA, ... B. SHIMEK.

PUBLISHED

BY AUTHORITY OF THE REGENTS.

IOWA CITY, IOWA:
DECEMBER, 1897.

VOL. IV. NO. 2.

BULLETIN

FROM THE

LABORATORIES OF NATURAL HISTORY

OF THE

STATE UNIVERSITY OF IOWA.

PUBLISHED
BY AUTHORITY OF THE REGENTS.

IOWA CITY, IOWA:
DECEMBER, 1897.

Secretary WM. J. HADDOCK:

We take pleasure in submitting herewith Bulletin No. 2, of Volume IV, from the Laboratories of Natural History, of the State University of Iowa.

THE EDITORS.

to the shores, and the fossil shells no doubt were developed under similar conditions.

The conclusion naturally follows that at one time the San Juan River and, of course, Lake Nicaragua, of which it is the outlet, had their low water mark more than fifteen feet above the present level; that the river has since cut through the eastern barriers to its present level, in its downward progress gradually depositing an oblique sheet of shell-bearing alluvium; and that the level of the lake has correspondingly fallen. Lake Nicaragua is to-day more than one hundred feet above sea-level. The San Juan River therefore has sufficient fall for further effective erosion, which is, without doubt, going on at an increasing rate, and the conclusion seems irresistible that the lake is destined to a further reduction of its level, and a still further contraction of its area, and that within no distant future: since it is evident from the comparatively perfect preservation of the shells above mentioned that the whole shell-bank is a very recent affair indeed, as terrestrial changes go.

In view of the attempted construction of vast public works along the valley of the San Juan River, the importance of this conclusion is sufficiently obvious.

While the lake cannot be wholly drained, its greatest depth being about two hundred and forty feet and the elevation of its surface above sea level being one hundred and ten feet, its average depth is such that a comparatively slight fall in its general level must cause a great contraction of its area,—a circumstance of much importance to the cities and towns along its shores.

The building of the proposed great Ochoa dam across the lower San Juan River in connection with the construction of the Nicaragua Canal is probably the only thing that would arrest this erosion, and would secure the retention of this vast and important inland reservoir of fresh water.

JUN 23 1915

THE COLEOPTERA OF THE LOWER RIO GRANDE VALLEY.

I.

BY H. F. WICKHAM.

THE material on which the following report is based, was for the most part, collected by the writer on a trip to Brownsville, Texas, in the year 1895. Owing probably to the comparative inaccessibility of the region, which lies far away from all ordinary routes of travel, and to a lack of knowledge of the means by which it might be reached, practically no collections of Coleoptera had, until recently, been received from this part of the country and the authenticity even of the few records in our possession was often questioned.

A short time previous to the writer's initial move in this direction, the Entomological Division of the U. S. Department of Agriculture stationed as Field Agent at Brownsville, Prof. C. H. Tyler Townsend, who was engaged in the study of the cotton weevil (*Anthonomus grandis*), and who also devoted much time to making a general collection of the insects found in this vicinity. Later, he was joined for a few days by Mr. E. A. Schwarz, who was sent by the same bureau on a like mission. To these gentlemen, naturalists are indebted for our first real knowledge of the insect fauna of the lower Rio Grande valley. Prof. Townsend remained at Brownsville throughout the writer's stay, and rendered a great deal of kind aid in the way of pointing out good localities with which he had become familiar in past experience. His mission was not terminated until some months later.

Two routes are open to the intending visitor; one by water, *via* the steamers of the Morgan Line, which touch at Brazos de Santiago, off Point Isabel, about once in ten days. The other is by stage from Alice, a station on the Mexican National and the San Antonio and Aransas Pass Railroads. This stage, running daily between Alice and Brownsville, covers the intervening distance of about one hundred and sixty miles in thirty-six hours. There is no means by which the trip can be made by rail.

Going south from Alice, the soil is for the most part sandy, the vegetation not unlike that of the major portion of southern Texas. Only after reaching the low lands extending back from the Rio Grande does any change appear and then only in spots. Here and there along the river-bottom, or along the sloughs or "resacas" are found, as Mr. Schwarz has elsewhere[1] stated, "isolated stripes of larger or smaller extent, covered with a dense forest having a thick undergrowth of varied shrubbery and a rich vegetation of lower plants, the like of which is not seen in any other place in southwestern Texas." It is, in the main, to these little jungles that the tropical forms are confined, while the elevated or more sandy portions in the neighborhood support generally only the ordinary flora and fauna of the region.

As to the nature of the vegetation in these jungles, little can be said except that it is quite unfamiliar in appearance to a traveler accustomed to the forests of any other portion of the United States. The palmetto here grows to the size of a tree, vines of various sorts bind the bushes into an almost impenetrable mass, brilliant abutilons and salvias gleam here and there in open spots. Often, however, the mesquite and allied Leguminosæ mingle freely with the curious isolated tropical growth and serve to render it still more unique. From one to another of the jungles stretches the "chaparral" of the Texas of literature—mesquite, huisache, two or three species of Opuntia and legions of thorny plants of gnarled growth and with scanty foliage. Toward the Gulf of Mexico, on the line of the little narrow-gauge road connecting Brownsville with its port, Point Isabel, lies a range of low hills—the "yucca ridges"—on which the growth of vegetation is that characteristic of the arid regions of the Lower Sonoran, great yuccas mingled with the usual legumes, mesquite, huisache and screw-bean. Here the insect-fauna takes on a character befitting its surroundings and we find the genera, often indeed the species, which occur in like situations in Arizona and Mexico.

---

[1] Proc. Ent. Soc. Washington, Vol. IV., p. 2.

Between these hills are wide valleys, salt in character and either baked dry and hard or covered more or less completely by the peculiar succulent plants common in such situations elsewhere in the west. These salt-flats extend in a somewhat broken sequence completely to the sea-coast at Point Isabel and support a few forms of insect life more or less peculiar to themselves. Reaching the Point, the long sand-beaches here and on Padre Island (across the narrow bay) are inhabited by a true maritime fauna, part of which may be called tropical in in its nature while the remainder is identical with that of the Gulf coast further north. All of the localities mentioned were visited by the writer, and some description of them is essential to a real understanding of the complex character of the Brownsville insect-fauna.

Regarding the true affinities of the Coleopterous fauna and the claim of the region to be considered tropical in its nature, opinions are more or less divided. Mr. Schwarz has stated, in the paper previously quoted, that "no one can doubt the existence of a semitropical insect-fauna along the north bank of the lower Rio Grande." Prof. Townsend[1] classes the Brownsville fauna as Lower Sonoran—with a considerable touch of Austroriparian and about twenty-five per cent tropical. Dr. Merriam[2] has included it in his Tropical region. Dr. LeConte,[3] writing thirty-seven years ago, speaks of it as a "sub-tropical province."

Looking through the list of species belonging to the five families treated in the present portion of this report, it seems

[1] Transactions of the Texas Academy of Science, 1895, p. 85.

[2] Proc. Biological Society of Washington, Vol. VII., p. 33 and map.

[3] Coleoptera of Kansas and New Mexico: Smithsonian Contributions.

to the writer that no one familiar with the Coleopterous fauna of the United States can pick out more than five or six which can be called characteristic of the Lower Sonoran zone, though it is true that quite a number range into it; a number, perhaps fifteen or sixteen, are tolerably characteristic of the Upper Sonoran, while possibly twelve or fourteen are more particularly tropical. The great majority are species of very wide distribution in eastern and central North America, many of them extending even to the Canadian boundary. No doubt can be entertained however, that a study of the phytophagous families will yield a larger percentage of Sonoran and Tropical species, since we may naturally infer that the carnivorous beetles, of which the present list is mainly composed, are less affected by peculiarities in the flora than the phytophaga. More will be said on the subject in the concluding number of this article; for the present it will be sufficient to state the conviction that there is even less ground for considering the Brownsville beetle-fauna as Lower Sonoran, than for classing it as Tropical. The little jungles noted by Mr. Schwarz, are to be considered it seems, almost truly tropical, while on the other hand, there are large areas of a very different nature surrounding these little forests, with a totally different coleopterous contingent. Some of these areas are, from their elevated situation and dry climate, almost typically arid Lower Sonoran, while the low-lying damp spots, not tropical, will show a high percentage of forms common in humid regions occupied by what Dr. Merriam has called the Carolinian and Austroriparian faunas. In other words, Brownsville and its environs are not in one life-zone but in at least two and probably three—the limits of these "zones" being locally irregular, and determined not by temperature-conditions but by those of soil and humidity which through their action on plant life also influence the insects. The only way in which these conditions could be approximately indicated on a map would be by spotting it with appropriate colors as in mapping boreal or arctic faunæ on isolated mountain peaks.

In compiling the list the writer has been fortunate in having the aid of such entomologists as Dr. Geo. H. Horn and Mr. E. A. Schwarz, to both of whom his best thanks are due. By the permission of Dr. L. O. Howard, Honorary Curator of the Department of Insects, the names of the species collected by Mr. Schwarz and Prof. Townsend and now preserved in the United States National Museum, have been added to the records and will be found in the proper places. When no credit is given, the writer is to be understood as the collector.

Dates are indicated by the months only; however those for June include the period between the twenty-first and the thirtieth, while those for July run from the first to the twentieth. Where no definite locality is specified, Brownsville is to be understood in every instance. For the benefit of future writers, in whose minds doubts may arise as to the possibility of any of the records referring to specimens actually captured on United States soil, it may be well to state that no systematic collecting was done on the other side. The Mexican specimens obtained were less than a score in number, incidentally gathered while looking over a cotton field near Matamoras, and these represented only species common on the north bank of the Rio Grande.

CICINDELIDÆ.

TETRACHA CAROLINA Linn. A number of specimens were taken in July, under pieces of wood along the bank of a resaca in Fort Brown reservation. The species extends quite across the continent in the south, being recorded from both coasts of Mexico; Florida, Alabama, Mississippi, Louisiana, Texas (Columbus, San Antonio, Laredo, El Paso), New Mexico (Mesilla Valley), Arizona (Tucson), California (Fort Yuma) and Baja California to San Jose del Cabo. According to Schaupp many varieties are known from the West Indies and South America.

CICINDELA RECTILATERA Chaud. Only tolerably common in the immediate vicinity of Brownsville in June and July, but much more abundant at various places along the stage route, literally swarming a little south of Alice. Plentiful at Columbus and Houston, along banks of streams or on margins of ponds; apparently preferring bars or other sandy stretches. Mexico (Chaudoir). Specimens were also included in Prof. Townsend's collection.

C. DORSALIS var. SAULCYI Guerin. Common on the white sand beach of Padre Island late in June, where it was captured by Prof. Townsend and myself. It is extremely abundant at Galveston and occurs at various other places on the Gulf coast —Florida and Louisiana. A strictly maritime species.

C. TORTUOSA Dej. Boca del Rio Grande; Prof. Townsend. This species is not not necessarily maritime, though often common on sea-beaches. It occurs, in several varieties, in Florida, Louisiana, Texas, Arizona, California (near San Diego), Baja California, the West Indies and Mexico.

C. MARGINATA Fabr. Point Isabel, on beach, one specimen, July. Occurs in the West Indies along the sea shore, also in similar situations in North and South Carolina, Georgia and Florida. In the neighborhood of New York City it is found on salt marsh.

C. SEVERA Laf. Point Isabel, rare on the beach in July. A species of wary habit and strong flight, more difficult of capture than any other species met with in the same region. Also known from Louisiana and New Mexico.

C. TOGATA. Laf. Not rare at Point Isabel, whence specimens are in Townsend's collections and my own. More common on salt-flats some distance back from the beach, also in the valleys near the yucca ridges. June and July. Common on salt marsh in Kansas and Nebraska.

C. CIRCUMPICTA Laf. Point Isabel, rare in July. Of much stronger flight than *togata*, and more wary. Only found in the immediate vicinity of the beach here, but elsewhere is not necessarily maritime. Found on salt marsh in Kansas and recorded from Arizona. The variety *prætextata* I have taken in New Mexico, at Albuquerque.

C. PAMPHILA Chaud. Point Isabel, along the beach, collected by Townsend and by myself. June and July. By far the most common tiger-beetle of the region and easily captured. Very variable. The ground color of the elytra may be either brownish, obscure bronzed green or bright green. Recorded also from Louisiana. Must certainly occur in the state of Tamaulipas, Mexico, though I have seen no specimens.

CARABIDÆ.

OMOPHRON AMERICANUM Dej. Rare on banks of resaca in July. Very widely distributed throughout the Mississippi valley, west to New Mexico and Colorado, east to New York, New England and Virginia. Also occurs in Canada.

CALOSOMA AUROCINCTUM Chaud. (Bull. de la Soc. Imp. Mosc. XXIII., 156.) Two specimens are in my possession, sent from Brownsville by Mr. Frank Armstrong, dated September. Prof. Townsend also met with it. Chaudoir's description is comparative with an Antillean species. In comparison with *C. scrutator* it will be seen that *aurocinctum* is smaller (23 mm.), of a much brighter and clearer green above, not becoming bronzed nor dark blue on the head and the pronotal disk. The sides of the prothorax are more suddenly narrowed behind, the margin less broadly reflexed; the cupreous border, so noticeable in most *scrutator* is nearly or quite wanting in *aurocinctum*. The elytral striæ are also much less pronounced, the interstices broader and flatter. The side margin of the elytra is brilliantly reddish-cupreous, but narrow. The species was originally described from Mexico and the above is the first record of its occurrence in the United States.

C. MACRUM Lec. Several specimens sent by Mr. Armstrong; September. Seems to be confined to Texas if we may judge from the records.

C. SAYI Dej. One specimen, from same source and with same date as above. This is known from most of the Atlantic and middle states as far north as Missouri. I have it from Missouri, Alabama and various localities in Texas. Dr. Horn has recently received specimens from Baja California.

SCARITES SUBTERRANEUS Fabr. Sent by Mr. Armstrong, who obtained it in September. Extends quite across the southern portion of the continent from Florida to Baja California, extending north on the Atlantic coast and through the Mississippi valley to Canada.

DYSCHIRIUS ERYTHROCERUS Lec. Rather common on the river bank at Laredo, July 24th. I find it recorded from Ohio and New York.

D. SUBLÆVIS Putz. The specimens provisionally placed here were taken by myself on the beach at Point Isabel. The specific reference is considered doubtful by Dr. Horn and also by Mr. Schwarz who obtained what is no doubt the same species. Putzeys' type was from Texas.

D. TERMINATUS Lec. Rather common on the banks of resacas at Brownsville in June and July, also at Laredo on river bank, July 24th. Extends across New Mexico and Arizona to California.

CLIVINA DENTIPES Dej. Common on shores of sloughs in July. Abundant at many points in the Atlantic states and in the Mississippi valley to Iowa. Louisiana, Georgia, Arizona (East Bridge on the Colorado River), California (Needles).

C. FERREA Lec. Brownsville, Prof. Townsend. Found in Iowa, Missouri, Kansas, Arizona (Tucson), Baja California.

SCHIZOGENIUS SALLEI Putz. Laredo. One specimen on river bank, July 24th. Originally described from Texas.

ASPIDOGLOSSA SUBANGULATA Chaud. Brownsville several, Laredo one specimen. Always found in situations similar to those frequented by *Clivina*. East to Louisiana, north to Dallas. Common at Columbus and San Antonio, Texas.

BEMBIDIUM COXENDIX Say. Laredo, July 24th, on river bank. Extends west to El Paso and to Albuquerque, New Mexico, whence I have specimens. For the identification of this and other species of the *Bembidia* I am indebted to Mr. R. Hayward, and the names will, in consequence, correspond with those used in his memoir now in press.

B. INTERMEDIUM Kirby. Laredo, common all along the Rio Grande. Abundant in Canada and southward through New York, Ohio and the Mississippi valley. In my cabinet also from several points in Texas; Luna, New Mexico, and Tucson, Arizona.

B. CONSTRICTUM Lec. Brownsville, July, not uncommon on banks of resacas. New York, New Jersey, Key West, Fla.

B. FRATERNUM Lec. Brownsville. The species thus referred, was so named by Mr. Schwarz, "only by comparison with specimens received from Belfrage." The material is from Townsend.

B. NUBICULOSUM Chaud. Common. Extends across the region to the westward, through El Paso, Albuquerque and the valley of the Little Colorado to Tucson and Yuma, thence through Baja California.

B. VERSICOLOR Lec. Common on wet banks. An abundant species throughout a wide extent of territory. I have it from Iowa City, Iowa, Little Rock. Arkansas, Tucson, Riverside and Winslow, Arizona, various points in Texas, The Dalles, Oregon, and Fort Wrangel, Alaska.

B. LÆVIGATUM Say. One specimen on bank of Rio Grande. Common at Columbus (Texas) and in Iowa. Recorded also from Ohio and Missouri.

TACHYS PALLIDUS Chaud. Not uncommon in June and July, under rubbish along the beach at Point Isabel.

T. XANTHOPUS Dej. Tolerably abundant in June at Brownsville. Said to be found in New York, New Jersey and westward. Allegheny, Pennsylvania (Hamilton).

T. VORAX Lec. Point Isabel and Brownsville, June and July, not rare. Known also from New Mexico, that part of California adjoining and south of Owen's Valley, Arizona and Baja California.

T. AUDAX Lec. Laredo, July 24th, on bank of river. California, in the same region as the preceding, also in Baja California.

T. CORRUSCUS Lec. Brownsville, June. Illinois, Pennsylvania.

T. VIVAX Lec. Not rare in July. This and all the other species of *Tachys* were identified by Dr. Horn.

POGONUS TEXANUS Chaud. A large colony of this hitherto very rare species was found under a palmetto log stranded on a mud-flat at Point Isabel. The beetle is remarkably active and the specimens displayed a degree of quickness in escaping rarely surpassed among the Carabidæ. The difference in facies in the genus *Pogonus* is quite remarkable. *texanus* bearing a close resemblance to certain *Amaræ*, while the other North American forms are more like *Agonoderus*. Probably *P. texanus* will prove to be a maritime or salt marsh species. No specimens are known to have occurred outside of Texas.

P. LECONTEI Horn. Obtained by Townsend, Schwarz and myself. It was not rare under drift-wood on the beach at Point Isabel in June and July. Found also near Great Salt Lake, Utah.

PTEROSTICHUS TEXANUS Lec. Apparently very common during September. A great number were received from Mr. Armstrong.

BADISTER MICANS Lec. Brownsville. Mr. Schwarz. Recorded from Massachusetts, Florida and Georgia.

PLATYNUS TEXANUS Lec. Several specimens were sent by Mr. Armstrong as having been collected during September. Also in Townsend's collection.

CASNONIA PENNSYLVANICA DeGeer. Brownsville, July, in cotton-field. Laredo, July 24th, under vines near river. Common in Iowa, extends north to Canada, east to New York and Massachusetts, west to Kansas. Baja California. According to Dr. Horn it occurs over the entire United States.

ZUPHIUM LONGICOLLE Lec. Brownsville. Mr. Townsend. One of the type specimens came from San Joaquin Co., Calif.

GALERITA ATRIPES Lec. Numerous specimens were collected in September by Mr. Armstrong. Rare in Iowa, abundant in Kansas.

AGRA OBLONGOPUNCTATA Chevr. (Coleop. du Mexique, 8e fascicule, 183). The first member of the *Agrini* reported from the United States. Several specimens were beaten from the thickest vine-covered tangles in the little tropical jungles already described. Mr. Townsend had two specimens (taken in June) on my arrival, and I continued to find it until late in July. The insect presents a most remarkable appearance. The head is impunctured, greatly elongate both before and behind the eyes, much constricted at the neck, surface polished. Thorax slender, nearly conical, sides sinuate near front and hind angles, lateral margin represented by a raised line: the disk is marked with four rows of very deep often confluent punctures, intermixed with a few less evident ones. Below the carina which I have considered to represent the lateral margin is another row of serial punctures more distinct in front, while beneath these will be seen a few scattered without arrangement. Elytra narrow, broader behind the middle, punctured in rows, the punctures large, deep, often elongate, wider than the interstices. Fourth interspace with a fine groove running nearly the entire length, margined interiorly by a delicate carina. From near the tip of the sixth interspace a fine carina extends to the vicinity of the rounded sutural angle. Apex of elytra truncate and sinuate, the outer angle nearly rectangular. Body beneath shining, prothorax coarsely, meso- and metathorax rather finely punctured; metasternum grooved at middle, the groove wider behind. A deep fovea just anterior to the middle coxæ. Abdomen nearly impunctured, at sides, each segment with a more or less distinct but indefinitely limited lateral impression, inside of which is a group of rather fine punctures. Median line polished, shining. Last ventral deeply angularly emarginate, the lateral impression deeper and with a more or less distinct fovea at bottom. Length 12 to 14 mm. The description is drawn up from two specimens both of which seem to be males. They agree in color, being of an obscure bronze, prothorax slightly greenish, legs tending to brownish or piceous. No Mexican specimens of *A. oblongopunctata* are at hand for comparison, the identification being made from description alone. The type came from the vicinity of Vera Cruz, Mexico.

EGA SALLEI Chevr. Swarming on the wet banks of sloughs all around Brownsville in June and July. This curious little beetle bears so great a resemblance to an ant, when in motion, that an inexperienced collector might readily be deceived. North to San Antonio.

TETRAGONODERUS LATIPENNIS Lec. Laredo, one specimen, July 24th. At Columbus this was perhaps the most abundant Carabid during my visit there in 1892, but on account of its peculiar coloration rather difficult to detect on the sandy banks which formed the favorite habitat.

T. FASCIATUS Hald. Three or four at Laredo under vines near river. Rather abundant at Columbus and fully as well protected by its coloration as the preceding species. Found as far north as Indiana, west and south to Arizona and Baja California.

LEBIA GRANDIS Hentz. Rare in June and July, among herbage or in tree-moss. Widely distributed, going north to Canada and Massachusetts, west to Arizona and Colorado; not uncommon in Iowa. Also in Townsend's collection.

L. BITÆNIATA Chevr. Rare in July; Mr. Schwarz took it in June. Occurs also in the state of Tamaulipas, Mexico.

L. VIRIDIS Say. Rare, July. One of our most widely distributed Carabidæ, occurring, as Dr. Horn has remarked, from Maine to Oregon, and south to Guatemala. It also inhabits Canada.

L. RHODOPUS Schwarz. Rare on vines in July. If this is in reality a variety of the preceding species, it is certainly very well marked. Found in Florida.

L. VIRIDIPENNIS Dej. Rare, in July. Extends north to Canada.

L. ORNATA Say. Common in June and July on flowers and herbage. "Occurs everywhere in our country" (Horn). This and the next species are also among the material collected by Mr. Townsend.

L. ANALIS Dej. Common through June and July in company with *ornata.* Widely distributed from north to south.

L. ABDOMINALIS Chaud. Rare in July. Mr. Schwarz took it in June. Found in Georgia and Missouri.

L. FURCATA Lec. Included in all the collections. I found it occasionally through June and July, but not commonly. It is very widely distributed, occurring from "Canada to Kansas and California," though apparently more abundant between the Mississippi River and the Rocky Mountains.

L. BIVITTATA Fabr. Rare, beaten from herbage in June and July. Massachusetts, New York, New Jersey, Pennsylvania, Colorado, New Mexico (Mesilla Valley).

MICRAGRA ÆNEA Putz. Several specimens were beaten from vines on the Fort Brown reservation in July. The insect is known from Brazil, northward through Central America, but has not hitherto been recorded from the United States. The identification is due to Dr. Horn. A short description of the beetle follows, by which it may be recognized. Form rather elongated, resembling that of *Metabletus*, but more slender; color blackish-bronzed. Head coarsely, not densely punctured, shining, a longitudinal impression just inside of each antennal ridge; sides moderately arcuately narrowed behind the eyes. Antennæ dark, reddish at base. Thorax apparently a little longer than broad, slightly broader than the head; sides distinctly but rather thickly margined, very slightly arcuate from the anterior angles to near the base, thence excurved to the hind angles which are almost rectangular, somewhat prominent. Base margined, truncate at middle, oblique on each side at hind angles, each of which bears a long seta, another bristle is on each side margin, near the middle. Disk rather coarsely punctured, the punctures so arranged as to give the appearance, under low power, of transverse rugosities.

Median line distinct, not deep except in two points near the middle of its length, where it is almost foveate. Elytra nearly twice as wide as the thorax, sides nearly parallel, slightly broader at about two thirds of the length, apex truncate and slightly arcuately emarginate, sutural angle not rounded, outer angle prominent. Surface striate, striæ shallow on the disk, deeper on the sides, discal interstices rather broad and flat. The punctures of the striæ are quite fine, though readily visible, closely placed, although not confluent, and are shallower in the discal striæ than in those of the sides. Under surface black, shining, prothorax punctured, abdomen nearly smooth. Legs black, tarsi piceous. Length 4 mm.

APRISTUS SUBSULCATUS Dej. Laredo, one specimen, July 24th. Common at Columbus. North to Canada, west to New Mexico.

BLECHRUS PUSIO Lec. Rare in July. "Ohio to Texas."

AXINOPALPUS BIPLAGIATUS Dej. Two specimens, sifted from dead leaves in July. Found over a very wide extent of territory; from Canada on the north, to New Mexico and Texas, and from Maine to California.

TECNOPHILUS CROCEICOLLIS var. PILATEI Chaud. One specimen found with the colony of *Pogonus texanus*, at Point Isabel; also sent to the National Museum by Mr. Towsend. The variety *pilatei* is, as far as known, confined to Texas, and includes those forms in which the head and thorax, above and beneath, also the legs, antennæ, meso- and metasternum are red, the elytra bright green or blue. In its varieties, the species is very wide-spread, extending from San Diego and Barstow, California, to Oregon, thence to Montana, Utah, New Mexico (Mesilla Valley, Coolidge), and Texas.

EUPROCTUS TEXANUS n. sp. Rufo-testaceous to rufo-piceous, shining. Head smooth on the occiput, impressed and roughened above the anterior half of the eyes, the impression extending forward to the base of the labrum. Clypeal region with a few small punctures; a frontal crescent-shaped impression, vaguely defined, from which radiate a few fine rugæ. Antennæ and palpi paler than the head, the former slightly darker at tip. Thorax about as in *E. trivittatus* Lec., base truncate at middle, oblique near hind angles, inside of which is a large deep foveiform impression; side margins narrowly reflexed. Disk finely transversely rugose, median line deep, not punctured, broader before and behind the middle. Elytra much broader than the thorax, slightly wider behind the middle, sides nearly parallel, apex obliquely truncate, the outer angle rounded, sutural nearly right. Striæ deeper on the disk shallower at the sides, strial punctures fine and close but distinctly separated. Interstices broad and flat, very finely alutaceous, each with a rather irregular row of punctures finer than those of the striæ. Two dorsal punctures between second and third striæ, one near the apex, the other about one-third from the base. Body beneath of same color as above, very sparsely punctured. Legs yellowish-testaceous. Length 5.25 mm.

This insect has been placed in *Euproctus* since it seems to fill all the requirements of the genus. In comparison with Dr. Horn's figure of *E. trivittatus* Lec., the following differences are manifest, none of which seem to me of sufficient importance to invalidate the generic reference: In *texanus* the penultimate joint of the labial palpi is quadrisetose and the bottom of the emargination of the mentum is very obtusely, hardly visibly bilobed. In all of the characters noted in the diagnosis[1] the correspondence is exact. A number of specimens were obtained by beating foliage in jungles during June and July. It was also met with by Mr. Schwarz.

CALLIDA PUNCTULATA Chaud. (Bull. de la Soc. Imp. Moscow, XXI., 1848, p. 87 in sep.) Form broad, resembling certain *Platyni;* color blackish, tinged with green on the head and thorax, a broad greenish margin on the latter. Beneath obscure greenish, tips of tibiæ and the tarsi piceous. Head longitudinally impressed each side above antennal ridges, a vague fovea between the anterior portions of the eyes from which point radiate fine rugosities. Labrum concave. Thorax broader than long; margin broad, more so at base, rather widely reflexed, sides broadly regularly arcuate to near the hind angles where they are slightly sinuate. Hind angles obtuse, hardly rounded, a deep but vague foveiform depression within, which is limited anteriorly by a rather indistinct carina. This carina is continued in the form of an elevated line, parallel with the side margin, nearly to the apex. Disk strongly transversely rugose. Elytra broad, sides nearly parallel, slightly broader behind the middle, apex truncate and slightly sinuate, sutural angle nearly right, not rounded. Disk flattened, striate, striæ impressed, very finely sparsely punctulate at bottom, interspaces broad, flat, or even slightly concave in places, sparsely irregularly beset with punctures which are larger than those of the striæ. Beneath shining, thorax indistinctly punctured, the abdomen finely rugose, the rugosities transverse in the median region, at sides radiating from vague impressions. Length 11.5 mm. Brownsville, beaten from plants in July. Mr. Schwarz has compared my specimen with Mexican examples and pronounces them identical.

---

[1] Horn, Trans. Am. Ent. Soc., x., p. 138.

C. PLANULATA Lec. Not uncommon, though by no means abundant, on herbage in the tropical jungles. At the time of Dr. Horn's revision of the genus, only one specimen, of doubtful locality, was known. The above record will therefore serve to fix the claim as native to the United States. Some specimens are almost testaceous in color, bronzed or greenish in the vicinity of the elytral humeri. June and July; Townsend and myself.

C. VIRIDIPENNIS Say. Brownsville; Mr. Townsend. Found in the Gulf States from Florida to Texas.

C. DECORA Fabr. Abundant at Browsnville, during the whole length of my stay, chiefly in the more humid spots, on herbage; not confined to the wooded regions, but common also in fields. Included in Townsend's series. Extends through the Gulf States and into Mexico.

PHILOPHUGA VIRIDICOLLIS Lec. Two or three specimens were found on the side curtains of the stage on the return trip to Alice, while between Brownsville and San Ignatius.

PINACODERA PUNCTIGERA Lec. Beaten from thick tangles of herbage in July. Known from Fort Yuma, California, and from Arizona.

APENES SINUATA Say. Two specimens, beaten from herbage in July. Widely distributed from New York, New Jersey, (Anglesea and Newark), Pennsylvania (Allegheny), through Iowa to Texas.

HELLUOMORPHA FERRUGINEA Lec. Received from Mr. Armstrong, under date of September; also taken by Mr. Townsend.

BRACHINUS FUMANS Fabr. Sent by Armstrong, dated September. Many specimens.

B. LATERALIS Dej. This and an undetermined species were among Mr. Townsend's captures.

CHLÆNIUS ORBUS Horn. Several specimens, taken by Mr. Armstrong; September. As far as known, this species is confined to Texas, where I have taken specimens as far north as Luling.

C. CHAUDOIRI Horn. One specimen, taken in September by Mr. Armstrong. Rare in collections. Previously known from Texas and the Mexican State of Tamaulipas.

ANATRICHIS OBLONGA Horn. One specimen on river bank in July. This species was described only five years ago, from a single specimen taken in "Texas, near the Rio Grande."

OODES QUATUORDECIMSTRIATUS Chaud. One specimen on river bank; July. Mr. Townsend also met with it. Rather common in the more northern portions of Texas, and in Louisiana.

O. CUPRÆUS Chaud. One specimen, on margin of resaca; June. I have seen this species in great numbers on the upper Rio Grande, at Albuquerque, New Mexico.

POGONODAPTUS PICEUS Horn. Very abundant along the low wet banks of resaca near Brownsville. It is easily procured by pouring water on the bank, thus driving it from the burrows. Takes flight almost at once on leaving shelter. Known only from Texas, and hitherto very rare in collections.

AGONODERUS LINEOLA Fabr. Only one specimen, smaller than usual and less distinctly marked. Of very wide distribution.

A. PALLIPES Fabr. One specimen; also a very common and widely distributed insect.

A. PAUPERCULUS Dej. Not common, inhabiting damp banks.

HARPALUS NITIDULUS Chaud. One specimen secured during July. "Southern and Western States, Kansas."

SELENOPHORUS PALLIATUS Fabr. El Sauz, June; common in September at Brownsville, (Armstrong). Also from Townsend. Recorded from Florida to Southern California.

S. FATUUS Lec. Common in July. I found it chiefly under rubbish in the low lands adjoining the river. Taken also by Mr. Townsend.

S. PERPOLITUS Casey. Rare under old yucca trunks in July, on the high ridges between Brownsville and the Gulf.

STENOLOPHUS SPRETUS Dej. One specimen, July.

BRADYCELLUS RUPESTRIS Say. In Mr. Townsend's collection. Said by Dr. Horn to occur over the whole of North America except Alaska and the Hudson's Bay region.

HALIPLIDÆ.

HALIPLUS RUFICOLLIS De Geer. Two specimens, doubtfully referred to this species, were taken in July. They are larger than any of my northern ones. A specimen of *Haliplus* is included in Townsend's collection.

CNEMIDOTUS 12-PUNCTATUS Say. Found in July. Common northward to Canada.

DYTISCIDÆ.

Laccophilus maculosus Germ. Occasional, in sloughs. Abundant northward, over the Atlantic slope.

L. americanus Aubé. Very common in ponds and sloughs during June and July. Contained also in Townsend's collection.

Bidessus pullus Lec. Common throughout June and July, in resacas. Also known from Louisiana and Mississippi.

Coptotomus interrogatus Fabr. Not common. Found in sloughs, during July. West to California, north to Canada, east to Atlantic coast.

Copelatus chevrolatii Aubé. Inhabits the resacas about Brownsville, but is not plentiful. June and July. Recorded from Lake Superior, Kansas, New Mexico, Arizona and California.

Eretes sticticus Linn. One specimen sent by Armstrong, dated September. Europe, Asia, Africa, Oceanica, South America. In the United States it is known from Kansas, New Mexico and California.

Thermonectes ornaticollis Aubé. Abundant in September, (Armstrong). Pennsylvania, Illinois, Kansas, New Mexico, (Albuquerque), Arizona and Mexico.

HYDROPHILIDÆ.

Hydrochus variolatus Lec. Common in resacas, near the bank. June and July. A specimen of this genus, in bad condition, is among the material sent by Townsend. The identification is due to Dr. Horn. Originally described from San Diego, California.

Ochthebius nitidus Lec. Common at Brownsville, same time and place as the preceding. Known from Lake Superior, Fort Yuma and Oregon.

Hydrophilus triangularis Say. September, (Armstrong). Abundant over the greater part of the United States, from the Atlantic to the Pacific, extending also into Canada and Mexico.

Tropisternus nimbatus Say. In sloughs, July. Canada to Georgia, west to Colorado and New Mexico.

T. ellipticus Lec. With the preceding. Not common. Also inhabits the Rio Grande valley of New Mexico, extending into California.

Berosus miles Lec. Not uncommon in sloughs. Originally described from Ringgold Barracks, some distance above Brownsville, on the Rio Grande. Recorded from Arizona and Baja California.

B. infuscatus Lec. Found in July. Extends across the southern part of the country, through all the Gulf States to California. Included in Townsend's collections.

B. striatus Say. Common with the foregoing. An abundant species from Canada to New Jersey, and west to Colorado.

Philydrus nebulosus Say. Not uncommon through June and July. Abundant from Canada to Arizona and California.

Creniphilus subcupreus Say. Abundant. Of very wide distribution.

Cercyon variegatus Sharp. Occasionally found in dung, throughout July. New Orleans and Morgan City, Louisiana, Columbus, Texas; through Mexico to Nicaragua.

C. pygmæus Ill. June and July, in same places as the preceding. Europe, Asia, Africa; Canada to Maryland, west to Iowa.

C. nigriceps Marsh. In dung, June and July. Found over most of the Eastern Hemisphere, while in this country it is known from Canada to the Gulf of Mexico, west to Louisiana and Indiana. A record is also in existence from Los Angeles, California.

THE FERNS OF NICARAGUA.

AN ACCOUNT OF THE FERNS COLLECTED BY THE NICARAGUA BOTANICAL EXPEDITION OF THE STATE UNIVERSITY OF IOWA IN 1893.

BY B. SHIMEK.

THE region which is covered by this paper is very narrow. It includes a strip along the San Juan River in Nicaragua in no case extending more that six miles from the river, and in addition to this the island of Ometépe in Lake Nicaragua. Yet within this narrow territory, in the brief space of less than four months, the author, while engaged in general botanical work, succeeded in collecting over one hundred and twenty species of Ferns,— more than four-fifths of the total number found within the limits of the United States. That the number is not greater is due to the fact that the work done in this brief period was rather in the nature of a general preliminary survey of the flora of the region under consideration.

Fournier[1] reports 121 species of Ferns from Nicaragua, and of these only about one-fifth occur in this list.

Hemsley[2] specifically credits Nicaragua with 135 species, of which only about two-fifths are found in this list, the others being largely from the mountainous district of Chontales.

Baker[3] and Hemsley[4] report 139 species from adjacent Costa Rica of which less than two-fifths are given in this paper.

---

[1] Ferns of Levy's collection, *Sertum Nicaraguense*, Bull. Soc. Bot. Fr., vol. XIX, pp. 249–261. Eug. Fournier.

[2] *Biologia Centrali-Americana. Botany*, vol. III.

[3] In Hook. and Bak. *Syn., Fil.*, pp. 457–525; *Journal of Botany*, vol. XXII, pp. 362–4.

[4] Biol. Cent. Am., vol. III.

No pretense is therefore made that the list of Ferns herein given is complete, even for the limited region under consideration. The vicinity of Greytown is the most promising fern-locality visited by the expedition, yet all the work in that vicinity was done within one week, during the greater part of which rain fell in torrents.

A full account of the topography and the prevailing climatic conditions of the region visited by the expedition has already been given by the author.[1]

For convenience the localities and dates are here repeated:

Ft. San Carlos; at the outlet of Lake Nicaragua. January 1st–4th, 1893.

Island of Ometépe, Lake Nicaragua. January 5th–February 10th.

Castillo Viejo. February 12th–March 23rd.

> The La Juana and Los Sabalos Rivers are tributary to the San Juan from the north. The La Juana east of Castillo, the Los Sabalos west.

Greytown. March 25th to April 1st.

> Camp Menocal is about fourteen miles west of Greytown, on the line of the proposed canal. Camp Seven is between Camp Menocal and Greytown. The Deseado River is a small stream which flows from the Divide at the point where this is to be cut by the canal toward Camp Menocal. The falls of the Deseado are near the Divide.

Boca del Rama. April 4th and 5th.

> This is on Bluefields River (Rio Escondido) about forty miles from its mouth.

For assistance in the preparation of this paper thanks are due, above all, to Prof. T. H. Macbride, whose energy and enthusiasm made the expedition possible, and whose suggestions in general, and those concerning arrangement and relationship in particular, have been of great assistance.

Much-needed assistance was also rendered by Prof. W. Trelease, who loaned valuable herbarium specimens and reference-books, by Prof. L. H. Pammel who furnished Hooker's *Icones Filicum*, and by Dr. C. M. Hobby, who loaned his fine collection of Hawaiian Ferns for comparison.

---

[1] *Bull. Lab. Nat. Hist.*, State Univ. of Iowa, vol. II, pp. 345–376.

. . . .

Tropical America is the Fern-paradise of the earth. No other corresponding division of the earth's surface presents as great a total number of species, or as many species which are peculiar to it. Nowhere else is the great variation in form and size, in structural characters and habits of growth, and in the arrangement and character of the reproductive organs better shown than here. This richness in the Fern-flora, exhibited in almost unlimited variety, is no doubt accounted for by the topography and contour of that part of the American continent which lies within the tropics. It is narrow when compared with the continents of the Old World, and it contains high mountain-chains which form its longest axis. Its narrow form brings all of it more or less within the influence of the adjacent oceans, which furnish to most of it an abundance of moisture. Its high mountains supply all the conditions effected by altitude, and moreover cut off the otherwise abundant moisture from certain areas. We have thus within comparatively restricted limits all the possible degrees of moisture and temperature, and the effect of environment finds abundant expression in the great variety of fern structures.

Excepting Palms perhaps, Ferns form the most conspicuous feature of the tropical vegetation. In size they vary from tiny representatives of the genus *Trichomanes* measuring only a fraction of an inch in height, to clinging vines like *Blechnum volubile* single fronds of which often exceed thirty feet in length, or to splendid tree-ferns which form the crowning glory of tropical vegetation.

Every conceivable form of outline and degree of division greet the eye, and in texture some rival the filmiest lace, while others develope thick leathery fronds wholly out of harmony with our ordinary conception of Ferns. In habit the variation is fully as great. In western Nicaragua, for example, where there is a distinct dry season, Ferns growing on bare volcanic rock become so dry that they may be ground to powder between the fingers. and yet they retain life. while in the eastern part, with its deep jungles in which perpetual shade and moisture prevail, the more delicate as well as the more gorgeous forms have full opportunity for the development of their many peculiarities.

The fierce struggle for existence which is constantly going on between the members of the vegetable world in this land of abundant moisture and perpetual summer has left its impress upon the flora in general. In the dense jungles the necessity of reaching upward to the realm of sunlight has resulted in the development of a distinct aerial flora. of which Ferns form by no means an inconspicuous portion.

This upward tendency on the part of the Ferns manifests itself in a variety of ways. Some species. as *Acrostichum sorbifolium* and *A. osmundaceum* send their rootstocks upward along trunks of trees or shrubs, often to a height of several feet, the rootstocks in some species bearing scattered fronds at intervals. in others being crowned at the tip with clusters of fronds.

Sometimes the part which connects with the soil dies away and an epiphyte results. That this has been the origin of epiphytes seems evident. In the course of their development as they advanced with the growth of the supporting plant the topmost branches of the tallest trees were ultimately reached. and spores scattered in this upper region by the wind. gave rise to an extensive aerial flora.

Another line of development however resulted from the struggle for light. if we are to judge from present indications.

Some such climbing Ferns. instead of severing their connection with the soil. and resting wholly upon the stem of the supporting plant. sometimes find that the support is destroyed and as a result, if the rootstock is not too long, and if it is sufficiently strong. which is often the case in the tufted forms, the fern remains erect sustained wholly by its rootstock, thus producing the effect and offering the first suggestion of a tree-fern.

That both epiphytes and tree-ferns gradually adopted their present habits is suggested both by the requirements of their surroundings, and by forms which to-day are intermediate between the strictly terrestrial sessile forms, and the epiphytes on one hand and tree-ferns on the other. The ferns which were collected on Ometépe are for the most part terrestrial. The occurrence in this part of Nicaragua of a distinct dry season which is less favorable to the development of epiphytes, no doubt accounts for the small number of such species, only one of the Ometépe list, *Polypodium incanum*, having this habit,—though one other, *Notholæna brachypus*, grows on almost bare volcanic rocks, and is really epiphytic. No tree ferns were found on Ometépe.

At Castillo, and more particularly at Greytown, the dry season is less marked, the forests better retain their vigorous verdure, offering plenty of moisture and shade to the exposed rootstocks and roots of epiphytes, and the number of such species among all plants is much greater,—the ferns forming no exception. Nearly one-half the species from Greytown and vicinity are epiphytes, and three are tree-ferns. The geographical distribution of these ferns is interesting. Only *two* species, *Gymnogramme tartarea* and *Nephrodium conterminum*, were found common to Ometépe, Castillo and Greytown. *Five* of the Ometépe species were also found at Castillo, and *fifteen* of the Castillo species were found at and near Greytown. That a greater number was not found common to the two latter localities is probably due to insufficient exploration at Greytown, for the conditions at these two places are somewhat similar, the greater extent of swampy lowlands at Greytown constituting the chief peculiarity. This variety in the fern-floras of localities not very remote from each other indicates the possibilities of a thorough exploration of the San Juan Valley and its adjacent highlands. Less than one thousand species of vascular plants have been reported from Nicaragua,[1] and about one-seventh, or 135[2] are Ferns.

---

[1] *Biologia Centrali-Americana*, vol. IV, p. 218. The number given is 984.

[2] *Ibid.*, p. 200. To this should be added 19 additional species reported by Fournier in *Sertum Nic.*, making a total of 154.

Since in addition to about 600 species of flowering plants about four-fifths of the reported number of Ferns were collected in so short a time, several of the species being new to the reported flora, and as the regions both north and south of the San Juan Valley have shown much richer floras upon a more careful investigation, it is safe to assert that scarcely more than a beginning has been made in the botanical study of this interesting region. In all cases care of course must be exercised in making use of locality lists as a basis for general conclusions, since the local distribution of ferns is quite as characteristic as that of tropical flowering plants, and none of the localities from which lists have heretofore been published have been sufficiently thoroughly worked to furnish full data. The need of such thorough work is made apparent when we consider the scattered local distribution of plants in general in tropical forests. Speaking of tropical forest trees, Wallace says:[1]

"If the traveler notices a particular species and wishes to find more like it, he may often turn his eyes in vain in every direction. Trees of varied form, dimensions and colors are around him, but he rarely sees any one of them repeated."

This scattering of individuals is probably a result of the sharp struggle which is going on in the tropical vegetable world under the most favorable conditions of heat and moisture, the strongest individuals of each kind, only being able to hold their own. Whatever may be the cause, the fact is striking, and the collector will often find it almost impossible to secure a large series of a species in one locality, while the variety of forms is quite bewildering and the slightest change in locality brings to him repeated surprises.

Not more than fifteen species in the following list are extensively gregarious, and in the more typical tropical forests of Castillo and Greytown no species was found which would compare in gregarious habit with the majority of the ferns of our northern forests.

---

[1] *Natural Selection and Tropical Nature*, p. 267. See also pp. 238-269 for a general account of tropical vegetation.

The classification which is employed in the following pages may require some explanation. In general that system of classification is best which most clearly shows the natural relationship of groups and species, and which is at the same time most convenient.

Lines are not so sharply drawn in the organic world that we may in any larger group express with absolute certainty the relationship which exists between its members, and frequently the attempt to do this in detail leads to a classification which is cumbersome, and which after all from the very nature of the case, neither does nor can give complete satisfaction to him who considers any system of classification merely an expression of relationship, nor can it save altogether from confusion the student who would use classification simply as a convenient means of reference,—an instrument which is to facilitate not retard his work. Considerations of reasonable expression of relationship, and of convenience and utility, would seem to dictate an intermediate course.

The confusion which exists in the nomenclature of tropical Ferns is partially explained by the great variation and intergradation of the species, but it is largely due also to the fact that the greater part of the systematic work which has been published was done by those who studied dried specimens only, these often mere fragments, or by those who had opportunities to observe growing plants only in conservatories where many of the species probably will not attain their normal development. In either case there has been needless multiplication of species based upon insufficient material, though occasionally the other extreme was reached and distinct forms were included under one specific name.

Probably no satisfactory solution of many of the problems of synonymy can be reached until the student of these interesting forms, well-equipped with apparatus and literature, will settle down for a protracted period in the region where they abound, giving his time not only to field-work but also to that close comparative study which is made possible only by years of residence.

The classification which is here presented contains no startling innovations. Some changes are made in the relative position of well-known groups with the view of securing a more convenient arrangement which will also give expression to existing relationship along the line of the characters upon which the classification is chiefly based.

A key to the larger groups is arranged, without, however, any attempt at a full definition of these groups, as they are sufficiently characterized by the standard authors.

The development of the *Filicineæ* seems to have been toward a suppression of the annulus, and toward a restriction of the spore-bearing areas, resulting in diminished sori with the indusia finally suppressed, or in limited specialized portions of the frond.

No linear arrangement of the groups will properly show the relationship which exists between them.

The suborders of the Subclass *Leptosporangiatæ*, for example, form a branching series of which the *Hymenophyllaceæ* and *Gleicheniaceæ* form the basal portion, or main stem, the *Hymenophyllaceæ* clearly constituting the first node, the structure of the lamina of the frond (often but one cell thick), the usually well-marked dorsi-ventral structure of the plant, the occasional development of root-hairs (rhizoids) only, in place of true roots, placing them near the Liverworts, and the production of a protonema-like prothallium in some species of *Trichomanes* suggesting the Mosses. The *Gleicheniaceæ* which form the second node still recall the Liverworts by their often marked dichotomy and by the frequent peculiar innovations of the frond, but in other respects they are more nearly like the higher groups of the sub-class. The species of both of these sub-orders have a complete transverse, equatorial annulus.

The development from this main stem is along two principal branches, namely toward the suppression of the horizontal annulus through the *Schizeaceæ*, where it is apical but complete, to the *Osmundaceæ* where it is sub-apical but rudimentary, on the one hand, and toward the vertical incomplete annulus of the typical *Polypodiaceæ* through the Family

Cyatheæ, on the other. The *Osmundaceæ*, by the structure and disposition of the fibro-vascular systems in the stem, represent the highest development of the sub-class, standing in this respect close to the *Coniferæ*.

The arrangement of the primary groups in this paper is that of Goebel's "Outlines of Classification."

The key which follows represents a grouping of forms according to the characters already cited.

In the sub-order *Polypodiaceæ* it is necessary again to note that an arrangement in a linear series is not possible. In the list the Families are of course placed in consecutive order, but the series here again is branching.

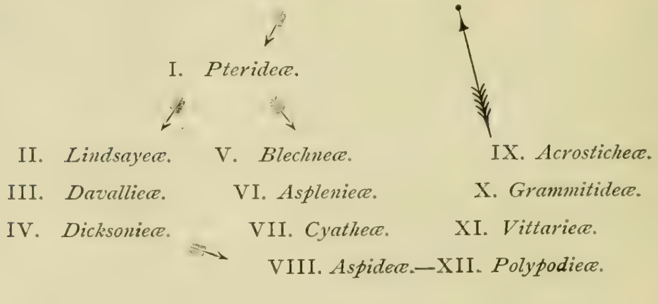
This sub-order illustrates development in two directions. First from the indusiate and involucrate type presented by the *Pterideæ* along two branches, one of which culminates in the *Dicksonieæ* and the other in the *Aspidieæ*, and second in the group of non-indusiate forms beginning with the *Acrosticheæ* with their scattered sporangia, and culminating in the *Polypodieæ* with well-defined sori.

The Families of each of the divisions so marked, are arranged with reference to the extent of the sori, those having the sori most limited in extent being placed highest.

Consequently in the consecutive arrangement which is necessary in the list, families like the *Dicksonieæ*, *Aspidieæ*, and *Polypodieæ*, which are really closely related, are seemingly widely separated.

The arrangement which is presented in the following diagram shows the relation more clearly.

Sub-order, POLYPODIACEÆ.



Each of the three groups tends toward the same general type,—namely a form with sori rounded, and indusium none as in *Phegopteris* and *Polypodium*. The first branch however falls short of the development reached by the other two, the *Dicksonieæ* all retaining an indusium.

The *Cythaeæ* and *Vittarieæ* do not form direct links in their respective series, but are rather lateral branches, the *Vittarieæ* from the *Grammitidieæ*, and the *Cyatheæ* from the *Aspidieæ*.

The *Cyatheæ* are here recognized as a family and not a sub-order. The obliquity of the annulus is not constant,[1] the development of a distinct caudex above ground does not always take place, beside occurring frequently among the *Dicksonieæ*, hence the elevated receptacle forms the only reasonably constant character by which the group can be distinguished from the *Aspidieæ*.

The following is a key to the Orders and Families of the

Class FILICINEÆ.

Sub-class I. **Leptosporangiatæ.** Sporangia developed from single epidermal cells. Heterosporous, or when homosporous the sporangium with a more or less developed annulus.

Sub-class II. **Eusporangiatæ.** Sporangia developed from a group of epidermal cells. Homosporous, the sporangium without an annulus.

Sub-class I. **Leptosporangiatæ.**

A. Spores of two kinds. . . . . Order I. HETEROSPORÆ.
Not represented in the collection.

B. Spores all alike. . . . . . Order II. HOMOSPORÆ.
  a. Sporangia with a well-developed annulus.
    1. Annulus transverse.
      i. Annulus equatorial.
        * Sporangia on filiform receptacles in marginal cup-like or two-valved involucres; mostly laxly-cellular.
        Sub-order I. HYMENOPHYLLACEÆ.
        ** Sori dorsal, without involucre.
        Sub-order II. GLEICHENIACEÆ.
      ii. Annulus apical. . . . Sub-order III. SCHIZEACEÆ.

---

[1] Upon this point see also pp. 41 and 42 of "*Historia Filicum*,"—John Smith.

2. Arnulus vertical or oblique; sporangia mostly stalked.
Sub-order IV. Polypodiaceæ.

i. Involucre present.[1]

* Sori marginal or sub-marginal.

† Involucre consisting in part or wholly of the reflexed margin of the frond.

1. Involucre single or double, the outer valve more prominent. . . . . . . Family I. Pterideæ.

2. Involucre single or double, the inner valve more prominent. Sori usually sub-marginal, linear.
Family II. Lindsayeæ.

†† Involucre not formed by the reflexed margin of the frond.[2]

1. Involucre squamiform, sometimes fastened at the edges.
Family III. Davallieæ.

2. Involucre cup-shaped or two-lipped.
Family IV. Dicksonieæ.

** Sori not marginal.

† Sori elongated, the indusium attached along one edge.

1. Sori linear, sometimes interrupted, parallel and close to the midrib of the frond or division.
Family V. Blechneæ.

2. Sori oblique to the midrib. Family VI. Asplenieæ.

††. Sori roundish.

1. Receptacle elevated. Mostly tree-ferns.
Family VII. Cyatheæ.

2. Receptacle not elevated. Family VIII. Aspidieæ.

ii. Involucre absent.

† Sporangia scattered over entire surface of frond or division. . . . . . Family IX. Acrosticheæ.

†† Sori linear, following veins, hence often pinnate or reticulated. Sporangia rarely also scattered between the veins. . . . . . Family X. Grammitideæ.

††† Sori linear, following veins, in sunken grooves.
Family XI. Vittarieæ.

†††† Sporangia rounded.[3] . Family XII. Polypodieæ.

[1] The genus *Hemitelia* of the *Cyatheæ* is without an indusium, but may be recognized by the elevated receptacle on which the sporangia are placed. The genus *Phegopteris* of the *Aspidieæ* is also without an indusium, but may be recognized by its venation, by the sori always being medial on the veins, and by the stipe being continuous (not jointed) with the caudex

[2] In *Endicksonia*, a sub-genus of *Dicksonia*, the outer valve of the involucre is formed by the apex of a segment, but the forms may be readily distinguished from the species of group † by their cup-shaped, two-valved involucre enclosing nearly globular sori which terminate veins.

[3] *Phegopteris* and *Alsophila* may be sought here. See foot-note.

b. Sporangia with annulus more or less rudimentary, or rarely wanting.

1. Annulus vertical or wanting. Sub-order V. CERATOPTERIDÆ.
Not represented in the collection.

2. Annulus subapical, transverse. Sub-order VI. OSMUNDACEÆ.
Not represented in the collection.

Sub-class II. **Eusporangiatæ.**

A. Fertile frond or segment distinct. Sub-order I. OPHIOGLOSSACEÆ.
Not represented in the collection.

B. Sporangia usually joined in *synangia* and borne on the back of the frond. Fertile fronds not differentiated.
Sub-order II. MARATTIACEÆ.

The notes on habit given in the annotated list which follows were taken in the field by the author. Under each species reference is made only to the works which were consulted for the distribution, description or figure of that species. The full list of the works consulted is given at the close of the paper. For convenience the names, printed in italics, of species heretofore reported from Nicaragua, but not collected by the author, are added at the end of each genus.

Class FILICINEÆ.

Sub-class I. LEPTOSPORANGIATÆ.

Order II. HOMOSPORÆ.

Sub-order I. HYMENOPHYLLACEÆ.

Genus HYMENOPHYLLUM *Smith.*

1. H. POLYANTHOS *Swartz.* Pl. 1, Fig. 1.

Hook. et Grev., Icon. Fil., Pl. CXXVIII; Hook., Sp. Fil., vol. 1, p. 106; Hook. and Bak., Syn. Fil., p. 60; Bed., Ferns of S. Ind., p. 88, pl. CCLXVII; Hemsley, Biol. Cent. Am., vol. III, p. 600; *ibid.*, vol. IV, p. 115 (from Costa Rica); Johow, An. de la Univ. Rep. de Chile, vol. LXXXII, p. 1000, fig. 29.

H. protrusum Hook.,—Hook., Sp. Fil., vol. 1, p. 104, Pl. XXXVII B.

H. jalapense Schl.,—Fournier, Bull. Soc. Bot. Fr., vol. XXVII, p. 249.

All of the specimens which were collected are sterile, but a careful comparison with authentic herbarium specimens.

and with the descriptions and figures cited, leaves but little doubt of the correctness of the determination.

Compared with Cuban specimens, and with the figures, the specimens are broader, and more nearly deltoid, but the pinnæ, though recurved, agree in the mode of division and the character of the segments.

Hooker (in Sp. Fil., vol. I, p. 107) says: "The fronds are not only variable in general form and circumscription, but also in the direction of the primary divisions, sometimes being curved downwards."

Most of our specimens have the lower and middle pinnæ recurved.

The species is reported from Chontales, Nicaragua, by Hemsley and Fournier, and from Realejo by Hooker as *N. protrusum*.

Rather common near Camp Menocal, creeping along the trunks of small trees.

2. H. CILIATUM *Swartz.*

Hook. et Grev., Icon. Fil., Pl. XXXV; Hook., Sp. Fil., vol. I, p. 88; Hook. and Bak., Syn. Fil., p. 63; Hemsley, Biol. Cent. Am., vol. III, p. 598; Bak., Biol. Cent., Am., vol. IV, p. 115 (from Costa Rica).

Our specimens are small, the fronds scarcely exceeding two inches in length, and the stipe in most of them is less than an inch long. The fronds are broader and somewhat less ciliate than represented in Hooker and Greville's figure.

This species has not heretofore been reported from Nicaragua. Not rare, creeping on the trunks of small trees near Camp Menocal.

Reported Species.

H. fucoides Swartz.

Fourn., Bull. Soc. Bot. Fr., vol. XXVII, p. 249, as *Leptocyonium pedicellatum* (Kze.), without locality; Hemsley, Biol Cent. Am., vol. III, p. 599, without exact locality.

H. valvatum H. & G.

Hemsley, Biol. Cent. Am., vol. III, p. 601, from Ometépe.

Genus TRICHOMANES (*L.*) *Smith.*

1. T. ELEGANS *Rudge.*

Hook., Sp. Fil., vol. I, p. 114; Hook. and Bak., Syn. Fil., p. 72; Hemsl., Biol. Cent. Am., vol. III, p. 602.

This well-marked species was rather common among exposed roots of trees along the rocky banks of a small stream in the deep woods, near Castillo. The fronds are mostly proliferous. It has not been reported from Nicaragua.

2. T. MEMBRANACEUM *L.* Pl. I, Figs. 2, 3.

Linn., System. Nat., vol. II, p. 696; Hook., Sp. Fil., vol. I, p. 115; Hook. and Bak., Syn. Fil., p. 73.

This interesting species was quite common on the wet clay-banks along a small stream in the deep woods near Castillo. In general appearance and habit it resembles the thallus of some of the larger liverworts, the fronds lying flat on the mud, over the surface of which the slender hairy rootstocks creep. None were found in other situations. The variation in the form and division of the frond is shown by Figs. 2 and 3, Plate I.

It is not reported in the *Biol. Cent. Am.*, and seems not to have been found heretofore in the Central American region.

3. T. PUNCTATUM *Poir.*[1] Pl, I, Figs. 4–11.

Hook. et Grev., Icon. Fil., pl. CCXXXVI; Hook., Sp. Fil., vol. I, p. 116; Hook. and Bak., Syn. Fil., p. 74; Hemsl., Biol. Cent. Am., vol. III, p. 602.

T. reptans Swartz,—Hook. et Grev., Icon. Fil., pl. XXXII; Hook., Sp. Fil., vol. I, p. 116; Hook. and Bak., Syn. Fil., p. 74; Hemsl., Biol. Cent. Am., vol. III, p. 603.

There seems to be no good reason for separating *T. punctatum* from *T. reptans.* The descriptions of the two forms in Hook. and Bak. *Syn., Fil.*, show practically no difference.

Hooker, in *Spec. Fil.*, vol. I, p. 116, says that *T. reptans* is distinguished from *T. punctatum* "by the long slender stipes." In *Icones Filicum*, in text accompanying pl. CCXXXVI, the same author says: "Its (*T. punctatum*) nearest affinity is with *T. reptans;* from which it is distinguishable by its much smaller, and rounder, imbricated and nearly sessile fronds, which are scarcely lobed at the margin, and never pinnatifid." In all of the characters mentioned, *i. e.* in the length of the stipe, the general outline, and the division of the frond, the Nicaraguan specimens show great variation. Upon the same rootstock occur sessile fronds and fronds with stipes one-half inch long. The base of the frond is usually cuneate, but sometimes even cordate, and the margin varies from quite entire to somewhat pinnately lobed, or even deeply palmately parted. The variation in these characters is shown by the figures.

---

[1] The author has had some trouble in determining which of the two names *T. punctatum* and *T. reptans* has precedence as neither of the original descriptions was at hand. As nearly as could be determined, however, from Jackson's "*Guide to the Literature of Botany*," Poiret's name is the earlier one. If this is an error the synonymy should be reversed.

According to both *Synopsis Filicum* and the plates of *Icones Filicum* size forms no distinctive character. The majority of the specimens are most nearly like the figures of plate XXXII in *Icones Filicum*, the involucre being particularly well-marked, but many of them differ from these figures and from the descriptions cited in having 12 to 15 sori,—instead of 1 to 4.

As compared with Wright's specimens from Cuba,[1] no. 915 (*T. sphenoides* Kz.), and no. 952 (*T. punctatum*), our specimens average somewhat larger, and have longer stipes for the most part, but in other respects they agree well,—even to the dense fringe of stellate hairs on the young fronds.

Common in the vicinity of Castillo, creeping on the trunks of small trees by the long, slender, branching rootstocks.

This is an addition to the Nicaraguan fern-list, though it has been reported from adjacent territory.

4. T. PUSILLUM *Sw.* var. QUERCIFOLIUM (*H. & G.*) *Bak.* Pl. II, Fig. 1.

Hook. and Bak., Syn. Fil., p. 465.

T. quercifolium Hook. et Grev., Icones Fil., pl. CXV; Hook., Sp. Fil., vol. I, p. 120.

T. pusillum Swartz (including *T. quercifolium* H. & G.),– Hook. and Bak., Syn. Fil., p. 77; Hemsl., Biol. Cent. Am., vol. III, p. 603.

---

[1] Kindly loaned by Prof. Wm. Trelease from the Herbarium of the Missouri Botanical Garden.

This name is used with some hesitancy. Twelve fronds only were collected, and of these some are almost exactly like the figures of pl. CXV in *Icon. Fil.*, not only in form, size and division, but also in texture, and in the position and form of the involucres, and the character of the marginal hairs.

The form should, it seems, rather be compared with *T. krausii* H. & G. from which it differs in the size and closer texture of the frond, and by its more exserted, larger-lipped, and more tapering involucres.

In our specimens the lower part of the rachis is hairy, like the stipe, and upon one specimen there are fifteen sori, the average being about five.

The rather scant material prevents a wider study of the form, and Baker's disposition of the case is adopted for the present.

Rather common at Camp Menocal, creeping about on the trunks of small trees.

T. pusillum (including *T. quercifolium*) is reported from Chontales, Nicaragua, by Hemsley (*ibid.*).

5. T. KRAUSII *H. & G.*

Hook. et Grev., Icon. Fil., pl. CXLIX;[1] Hook., Sp. Fil., vol. I, p. 120; Hook. and Bak., Syn. Fil., p. 77; Hemsl., Biol. Cent. Am., vol. III, p. 602.

Didymoglossum krausii Presl,—Fourn., Sertum Nic., p. 249.

Our specimens agree with the plate in *Icones Filicum*, both sessile and stipitate fronds occurring on the same rootstock. The stipes in some specimens are one-half inch long. The base of the frond varies from broadly truncate in the sessile forms, to narrowly cuneate in those which are stipitate. One specimen has the cup of the involucre and the adjacent margins of the frond densely ciliated with short whitish hairs in addition to the sparse stellate hairs which occur in the sinuses.

Common, creeping on the trunks of small trees in the deep woods in the vicinity of Castillo.

Reported by Fournier from Nicaragua without locality.

---

[1] The plate is marked *T. incisum*, but the name *T. krausii* is used in the text.

6. T. BRACHYPUS *Kunze.* Pl. II, Figs. 2, 3.

Hook., Sp. Fil., vol. I, p. 121; Hook. and Bak., Syn. Fil., p. 80.

T. radicans Hook. et Grev. (non Swartz), Icon. Fil., pl. CCXVIII.

T. ankersii Parker,—Hook. et Grev., Icon. Fil., pl. CCI.

This well-marked species was rather common near Camp Menocal, climbing on the trunks of trees by its slender, black rootstocks.

Some of the fronds have a distinct lobe on the lower side of the lowest pinna at the base. This is somewhat developed in specimens from Guadaloupe and Surinam with which comparison was made, but is not so prominent in them as in the frond from Nicaragua figured on plate II. The involucres are very slender, prominently exserted, and often deflexed.

The species has not been heretofore reported from the Central American region.

7. T. PYXIDIFERUM *L.* Pl. II, Figs. 4–6.

Linn., Sys. Nat., vol. II, p. 696; Hook. et Grev., pl. CCVI; Hook., Sp. Fil., vol. I, p. 124; Fourn., Bull. Soc. Bot. Fr., vol. XV, p. 144; Hook. and Bak., Syn. Fil., p. 81; Hemsl., Biol. Cent. Am., vol. III, p. 603; Johow, An. de la Univ. Rep. de Chile, vol. LXXXII, p. 1003.

T. cavifolium C. Mill.,—Fourn., Bull. Soc. Bot Fr., vol. XV, p. 144.

T. olivaceum Kunze,—Fourn., Sertum Nic., p. 249.

Some of the fronds in the collection are almost identical with those figured by Hooker and Greville, though smaller, while others are shorter, broader, and more divided. In all other details, including texture and the broad undivided mouth of the involucre, they are the same. The stipes vary from ⅛ to 1 inch, and none of the fronds (without stipe) exceed 2 inches in length.

Growing with *T. krausii* near Castillo. Not common.

The only record of its occurrence in Nicaragua is in Fournier's *Sertum Nicaraguense*, where it is listed without locality.

8. T. RADICANS *Swartz* (non H. & G.). Pl. III, Figs. 1–3.

Hook., Sp. Fil., vol. I, p. 125; Fourn., Bull. Soc. Bot. Fr. vol. XV, p. 144; Hook. and Bak., Syn. Fil., p. 81; Williamson, Ferns of Kentucky, p. 123, pl. XLVIII; Eaton, Ferns of N. Am., vol. I, p. 179, pl. XXIV, fig. 1; Fourn., Sertum Nic., p. 249; Underwood, Our Nat. Ferns and their Allies, p. 112; Chapm., Fl. of the So. St., p. 597; Hemsl., Biol. Cent. Am., vol. III, p. 603; Gray, Manual of Bot., p. 692; etc.

T. kunzeanum Hk., Sp. Fil., vol. I, p. 127, pl. XXXIX D.

T. scandens L.,—Fourn., Bull. Soc. Bot. Fr., vol. XV, p. 144.

T. mexicanum V. den B.,—Fourn., Sertum Nic., p. 249.

The form collected in Nicaragua recalls most nearly the var. *kunzeanum* Hk., but it has the rachis distinctly winged throughout, the stipe very short and winged, and the pinnæ more blunt and shorter, the frond gradually tapering toward both extremities; the lower pinnæ, sometimes all in the lower half of the frond, are reflexed, the lowest pair often being not more than ¾ of an inch in length. The fronds are from 12 to 16 inches long, and 2½ to 4½ inches broad,—the stipe ¾ to 2½ inches. The involucre varies from two-lipped or winged, to entire without spreading border.

Careful comparisons were made with specimens from numerous tropical and subtropical countries, and there seems to be no question concerning the position of this splendid form, which may, however, be deserving of varietal rank.

The name *T. scandens* L. was applied by Fournier to No. 20 of Fendler's Venezuelan collection. An examination of Fendler's fern, however, proves it to be *T. kunzeanum* (or *T. scandens* V. den B.),[1] and not *T. scandens* L.

Reported from Chontales, Nicaragua, by Fournier and Hemsley (*ibid.*).

Rather common, creeping on trunks of trees in deep woods near Camp Menocal.

9. T. CRISPUM *L.*

Linn., Syst. Nat., vol. II, p. 696; Presl, Rel. Haenk., vol. I, p. 69; Hook. et Grev., Icon. Fil., pl. XII; Hook., Sp. Fil., vol. I, p. 130; Fourn., Bull. Soc. Bot. Fr., vol. XV, pp. 144–5; Hook. and Bak., Syn. Fil., p. 82; Hemsl., Biol. Cent. Am., vol. III, p. 601; Baker, Biol. Cent. Am., vol. IV, p. 115, (from Costa Rica).

The Nicaraguan specimens are small, averaging 2 inches in the length of the stipe, and 4 inches in the length of the frond. One frond only measures 7 inches in length.

---

[1] See note under *T. radicans* in Hook. and Bak., Syn. Fil., p. 82.

The specimens are however quite typical.

Common on moss-covered trunks of trees near Camp Menocal and Greytown.

The species is now reported from Nicaragua for the first time.

10. T. PINNATUM *Hedwig.*

Hook. and Bak., Syn. Fil., p. 84; Hemsl., Biol. Cent. Am., vol. III, p. 602.

T. floribundum H. B. K.,—Presl, Rel. Haenk., vol. I, p. 68; Hook. et Grev., Icon. Fil., pl. IX.

Neuromanes hedwigii V. den B.,—Fourn., Bull. Soc. Bot. Fr., vol. XV, p. 249; Fourn., Sertum Nic., p. 249.

This well-defined species was found sparingly on trunks of trees in the deep woods near Camp Menocal.

Fournier (*ibid.*) reports it from Chontales, Nicaragua.

11. T. PRIEURII *Kunze.*

Kunze, Analec. Pterid., p. 48; Fourn., Bull. Soc. Bot Fr., vol. XV, p. 144; Hook. and Bak., Syn. Fil., p. 86.

T. anceps Hook., Sp. Fil., vol. I, p. 135, pl. XL C.

This species, which is not credited to the Central American region by any of the works at hand, was found sparingly in the vicinity of Camp Menocal, growing in tufts in rich soil in deep woods. The fronds have a peculiar coppery or olive green color which changes to nearly black upon drying.

Our specimens agree exactly with L'Herminier's collection from Guadaloupe.[1]

Reported Species.

T. alatum Swartz.

Fourn., Sertum Nic., p. 249; Hemsl., Biol. Cent. Am., vol. III, p. 601;–both report this species from Nicaragua, without exact locality.

T. daucoides Presl.

Fourn., Sertum Nic., p. 249, Ometépe; Hemsl., Biol. Cent. Am., vol. III, p. 602, Ometèpe.

T. scandens L.

Fourn., Sertum Nic., p. 249; Hemsl., Biol. Cent. Am., vol. III, p. 604; both without exact locality.

---

[1] In the Herbarium of the Missouri Bot. Garden.

T. trichoideum Swartz.

Fourn., Sertum Nic., p. 249, without exact locality; Hemsl., Biol. Cent. Am., vol. III, p. 604, Chontales.

Sub-order II. GLEICHENIACEÆ.

Genus GLEICHENIA *Smith.*

1. G. PUBESCENS (*H. B. K.*) *H. & G.*

Hook., Sp. Fil., vol. I, p. 8; Eaton, Fil. Wr. et Fend., p. 216; Hook. and Bak., Syn. Fil., p. 13; Hemsl., Biol. Cent. Am., vol. III, p. 590; Bak., Jour. of Bot., vol. XXII, p. 362.

Mertensia farinosa Kaulf.,—Kunze, Anal. Pterid., p. 6, pl. III.

G. immersa H. & G., Icon. Fil., pl. XV.

Mertensia tomentosa Swartz,—Fourn., Sertum Nic., p. 261.

Growing 1 to 2 feet high. Fronds, especially rachises, paleaceous and quite downy.

Rare, growing on bank of R. R. cut near Greytown.

Fournier and Hemsley (*ibid.*) both report it from Chontales, Nicaragua.

Sub-order III. SCHIZEACEÆ.

Genus LYGODIUM *Swartz.*

1. L. VENUSTUM *Swartz.* Pl. III, Figs. 3, 4.

Presl, Rel. Haenk., p. 72 (the species credited to Sprengel); Eaton, Fil. Wr. et Fend., p. 217; Hook. and Bak., Syn. Fil., p. 438; Fourn., Sertum Nic., p. 261; Hemsl., Biol. Cent. Am., vol. III, p. 695.

Common along fences and edges of clearings on Ometépe. The fronds climb to a height of 20 feet. Reported from Ometépe by Fournier and Hemsley (*ibid.*)

REPORTED SPECIES.

L. commutatum Presl.

Fourn., Sertum Nic., p. 261, without exact locality; Hemsl., Biol. Cent. Am., vol. III, p. 695, on authority of Fournier.

L. heterodoxum Kunze.

Fourn., Sertum Nic., p. 261, Chontales (also reported *ibid.*, from same locality, as *L. spectabile* Liebm.); Hemsl., Biol. Cent. Am., vol. III, p. 695, Chontales.

L. oligostachyum Desv.

Fourn., Sertum Nic., p. 261, Ometépe; Hemsl., Biol. Cent. Am., vol. III, p. 695, on authority of Fournier.

Anemia Swartz.

A. adiantifolia Swartz.

Fourn., Bull. Soc. Bot. Fr., vol. XVII, p. 236; Fourn., Sertum Nic., p. 261, near Nandaimé; Hemsl., Biol. Cent. Am., vol. III, p. 692, without locality.

A. breuteliana Presl.

Fourn., Sertum Nic., p. 261 (as *A. incisa* Schrad. from Ometépe, and *A. filiformis* Sw. from Granada); Hemsl., Biol. Cent. Am., vol. III, p. 693, Ometépe and Granada.

Sub-order IV. **POLYPODIACEÆ.**

Family I. **PTERIDEÆ.**

Genus PTERIS *Linn.*

1. P. BIAURITA *Linn.* Plate IV, Figs. 1–6.

Linn., Sys. Nat., vol. II, p. 688; Hook. et Grev., pl. CXLII; Hook., Sp. Fil., vol. II, p. 203; Fourn., Bull. Soc. Bot. Fr., vol. XV, p. 18; Hook. and Bak., Syn. Fil., p. 164; Hemsl., Biol. Cent. Am., vol. III, p. 622.

P. nemoralis Willd.,—Presl, Rel. Haenk., p. 56; Hook, Sp. Fil., vol. II, p. 202.

P. galeotti Fèe,—Hook., Sp. Fil., vol. II, p. 204.

Campteria biaurita Linn,—Beddome, Ferns S. Ind., pp. 14, 69, pl. XLIV; Smith, Hist. Fil., p. 293.

P. quadriaurita Retz.,—Hook., Sp. Fil., vol. II, p. 179, pl. CXXXIV B; Eaton, Fil. Wr. et Fend., p. 203; Beddome, Ferns S. Ind., pp. 11, 69, pl. XXXI; Hook. and Bak., Syn. Fil., p. 158; Hemsl., Biol. Cent. Am., vol. III, p. 625; Bak., Biol. Cent. Am., vol. IV, p. 115.

P. edentula Kunze,—Fourn., Sertum Nic., p. 258.

This widely distributed species presents a variety of forms which have given rise to an extended synonymy. In the Nicaragua collection three forms appear:

1. Typical *P. biaurita* with arching veins connecting the bases of the midribs of the lobes of the pinnæ, represented in Pl. IV, fig. 1.

Not rare near the foot of the volcano Ometépe.

2. Typical *P. quadriaurita* without the arching veins below

the sinuses of the lobes, *i. e.* all the veins free, as in pl. IV, Fig. 3.

In these specimens the basal veins of each lobe usually spring from the midrib of the lobe, but occasionally a vein arises from the mid-rib of the pinna, as shown in Pl. IV, fig. 2, thus approaching the following form. Figs. 2 and 3 represent parts of the same pinna.

Not rare on Ometépe, with the preceding form.

3. A form intermediate in venation between 1 and 2, corresponding to *P. nemoralis*. In this form most of the pinnæ have free veins springing from the mid-rib between the midribs of the lobes, but occasionally these veins unite with the basal vein from the adjoining lobe, as shown in Pl. IV, fig. 4, thus approaching typical *P. biaurita*.

This form was very common in deep woods near Castillo, growing in scattered clusters and reaching a height of 20 inches. Most of the fronds collected were pentagonal in form, with but two lateral pinnæ on each side, the lower one with a prominent division near the base on the lower side. One specimen has four pinnæ on a side and the basal pinna on one side is simple. In form this latter frond is like 1 and 2, which have the fronds elongated. It differs however, as do all the others of this group, in having the pinnæ tapering toward the base, as represented in Pl. IV, fig. 6, those of groups 1 and 2 being truncate, as in fig. 5, though sometimes unequal at base.

The venation in this group resembles that of *P. anamallayensis* Beddome.[1] which, unless the termination of the veins in dots remote from the margin proves a constant character, should probably be added to this series.

An examination of the entire series shows that venation is not to be relied upon,—a fact already established by various authors.

Hooker,[2] referring to the fact that Linné in his herbarium united *P.* (*Campteria*) *biaurita* and *P. nemoralis*, says: "The *Campteria* Agardh has no doubt correctly referred to *Pt.*

---

[1] Beddome, Ferns of S. Ind., pp. 14, 69, pl. XLV.

[2] Species Filicum, vol. II, p. 181.

biaurita L. *Pt. nemoralis* he retains, and places next to our *Pt. quadriaurita*, with characters however, which would seem to combine these two species (or genera), and my own investigations would lead to this conclusion."

Fournier[1] after discussing the venation of *P. biaurita* (*P. nemoralis*), concludes as follows:

"Ceci prouve qu'il ne faut pas accorder à la venation une importance exagérée dans la classification des Fougéres."

Beddome,[2] under *Campteria biaurita* adds:

"Without examining the venation this fern is hardly distinguishable from *Pteris quadriaurita*."

Baker,[3] in a note under *P. biaurita* says:

"This differs only from *P. quadriaurita* in the pinnæ being less deeply pinnatifid[4] and the bases of the mid-rib of the segments being connected by an arching vein. This arch springs normally from the bases of the mid-ribs, but sometimes begins and ends at points between them. It is sometimes triangular, sometimes very low, and in what Agardh considers as *P. nemoralis* Willd., we have the venation considered as characteristic of *biaurita* combined with the entirely free venation considered as characteristic of *quadriaurita* in one and the same frond, so that they must be regarded as very doubtfully distinct."

As venation forms the one character upon which has been based the distinction between *P. biaurita* and *P. quadriaurita*, all other characters being confessedly uniform in the whole series, or not constant, and as this character is clearly unreliable as shown by the material in hand, as well as by the authors cited, there seems no reason why the artificial distinction should longer be maintained. The forms are all accordingly united under the oldest name, *P. biaurita* L.

In habit all of the forms which were collected were terrestrial.

---

[1] Bull. Soc. Bot. Fr., vol. xv, p. 18.

[2] Ferns of Southern India, p. 14.

[3] Synopsis Filicum, Hooker and Baker, p. 164.

[4] A character which is very variable.

Hemsley reports this species from Chontales under the name *P. quadriaurita*, and Fournier reports it, from the same place, as *P. edentula* Kze. Typical *P. biaurita* has not heretofore been credited to Nicaragua.

2. P. HIRSUTA (*L.*) *Hook.*

Smith., Hist. Fil., p. 297.

Lonchitis hirsuta L., Sys. Nat., vol. II, p. 689.

P. laciniata Willd.,—Hook., Sp. Fil., vol. II, p. 176, pl. CXXXII; Eaton, Fil. Wr. et Fend., p. 203; Hook. and Bak., Syn. Fil., p. 160; Hemsl., Biol. Cent. Am., vol. III, p. 623.

This common species has long been known under the name *P. laciniata* Willd. As it is synonymous with *Lonchitis hirsuta* L., the specific name used by Linné should be retained.

Quite common in the deep woods near Castillo, and like all the species of *Pteris* in this list, terrestrial in habit.

The stipes, rachises, etc., vary from quite hairy to almost smooth.

The species has not heretofore been reported from Nicaragua.

3. P. ACULEATA *Swartz.*

Hook., Sp. Fil., vol. II, p. 224; Eaton, Fil. Wr. et Fend., p. 204; Hook. and Bak., Syn. Fil., p. 171; Hemsl., Biol. Cent. Am., vol. III, p. 621; Baker, Jour. Bot., vol. XXII, p. 362.

P. propinqua Ag.,—Hook., Spec. Fil., vol. II, p. 223.

P. apicalis Liebm.,—Fourn., Sertum Nic., p. 258.

The Nicaraguan material answers in many respects to the descriptions of *P. podophylla* Swtz. The fronds are more or less distinctly tri-partite, but the regularity of the division is destroyed in some specimens by the fact that the two lateral divisions do not spring from the same level, resembling in this respect large compound pinnæ, and that the lower pinnæ of the middle division are often compound, though always much smaller than the two lateral divisions. In one specimen the lower pinnæ of the lateral divisions are also somewhat compound.

That there has been more or less confusion in the conception of this species is evident. Baker[1] places the species among the *Bipinnatæ*, while Smith[2] includes it in the division of *Litobrochia* which has the fronds "deltoid tri-partite."

Baker, however, on p. 172, under *P. luschnathiana* Bak., a species which belongs to the *Tripartitæ*, says that it "seems a variety of *aculeata*,"—a practical admission of the variation in the division of the frond in the latter species, of which *P. luschnathiana* is probably a synonym.

The variation in the extent to which the division of the frond is carried will probably necessitate the union of *P. aculeata* and *P. podophylla* under the former name.

The Nicaraguan specimens have rather small terminal pinnæ measuring 4 to 6 inches in length, the divisions closely resembling Mexican forms of *P. propinqua* in the University Herbarium. The stipes are mostly smooth. A fine series was collected. The fronds were solitary, growing rather abundantly in damp soil in the deep woods near Castillo.

Reported from Chontales by Hemsley (*ibid.*), and from Nicaragua without locality as *P. apicalis* by Fournier.

4. P. INCISA *Thunb.* Pl. V, Figs. 1, 2.

Hook., Sp. Fil., vol. II, p. 230; Eaton, Fil. Wr. et Fend., p. 204; Hook. and Bak., Syn. Fil., p. 172; Hemsl., Biol. Cent. Am., vol. III, p. 623; Bak., Biol. Cent. Am., vol. IV, p. 115 (from Costa Rica); Johow, An. de la Univ. Rep. de Chile, vol. LXXXII, p. 982, fig. 6.

P. aurita Bl.,—Hook., Sp. Fil., vol. II, p. 231.

The fronds average about three feet in total length, and are glaucous beneath. The rootstock is creeping, and covered with brown scurfy scales. The venation, as represented in the figures, is rather constant in the material which was collected, but is generally very variable in the species. This species, like *P. biaurita*, shows the comparatively slight value of the generic and specific characters based upon venation which have been recognized by many authors in the genus *Pteris*.

Collected on the volcano Ometépe at an altitude of about 3,000 feet. Not common.

---

[1] Hook. and Bak., Syn. Fil., p. 171.

[2] Historia Filicum, p. 291.

Hemsley (*ibid.*) reports it from Nicaragua without exact locality.

5. P. ELATA *Agardh.*

Hook., Sp. Fil., vol. II, p. 223; Eaton, Fil. Wr. et Fend., p. 204; Hook. and Bak., Syn. Fil., p. 173: Hemsl., Biol. Cent. Am., vol. III, p. 623.

Apparently typical specimens of this species were collected near the foot of the volcano Ometépe, and along the Deseado River near Camp Menocal.

Those from the latter locality are more coriaceous, being older, and have stipes two feet in length. The stipes were green in the living fronds.

The species was not uncommon in both of the localities mentioned, and in habit closely resembled *P. aquilina*. It has not heretofore been specifically reported from Nicaragua.

REPORTED SPECIES.

P. aquilina L. var. *caudata* (L.) Hook.

Fourn., Sertum Nic., p. 258, as *P. caudata* L., from Chontales.

P. aquilina L. var. *lanuginosa* (Bory) Hook.

Fourn., Sertum Nic., p. 258, as *P. decomposita* Gaud., from Chontales.

P. pungens Willd.

Fourn., Sertum Nic., p. 258; Hemsl., Biol. Cent. Am., vol. III, p. 625. Both from Chontales.

Pellæa Link.

P. angustifolia (H. B. K.) Bak.

Fourn., Sertum Nic., p. 258 (as *Cheilanthes angustifolia* Hook.); Hemsl., Biol. Cent. Am., vol. III, p. 618. Both from Ometépe.

Cheilanthes Swartz.

C. radiata (L.) Sm.

Hemsl., Biol., Cent. Am., vol. III, p. 616, from Chontales.

C. viscosa Kaulf.

Hemsl., Biol. Cent. Am., vol. III, p. 617, from Realejo.

HYPOLEPIS *Bernh.*

1. H. REPENS (*L.*) *Presl.* Pl. v, Fig. 4.

Hook., Sp. Fil., vol II, p. 64, pl. xc, B.; Hook. and Bak., Syn. Fil., p. 129; Hemsl., Biol. Cent. Am., vol. III, p. 613; Bak., Biol. Cent. Am., vol. IV, p. 115.

Lonchitis repens L.,—Linne, Syst. Nat., vol. II, p. 689.

Although this species was quite common near Camp Menocal along the Deseado River bottoms, only one specimen was collected.

The fronds measured 8 to 9 feet in total length, being larger than stated in Hooker and Baker's *Synopsis Filicum.* The fronds are broadly triangular, 3 to 4 pinnate, with spiny stipe and rachis.

Not heretofore reported from Nicaragua.

2. H. HOSTILIS *Presl.* Pl. v, Fig. 3.

Hook., Sp. Fil., vol. II, p. 69; Hook. and Bak., Syn. Fil., p. 130; Hemsl., Biol. Cent. Am., vol. III, p. 612.

A specimen which was collected near Camp Menocal is referred to this species. It answers well to the descriptions cited but there is some question as to the distinction between this and the preceding form, as has already been noted by Baker.[1]

Since the material is scant, no attempt is here made to determine the relationship and synonymy of the members of this group of the genus.

The species is new to the Nicaraguan list.

ADIANTUM *Linn.*

1. A. OBLIQUUM *Willd.* Pl. v, Figs. 5–10; Pl. VI, Figs. 1–5.

Hook., Sp. Fil., vol. II, p. 8, pl. LXXIX, A; Eaton, Fil. Wr. et Fend., p. 201; Hook. and Bak., Syn. Fil., p. 115; Fourn., Sert. Nic., p. 259; Hemsl., Biol. Cent. Am., vol. III, p. 610.

A. kaulfussii Kunze,—Hook., Sp. Fil., vol. II, p. 7; Eaton, Fil. Wr. et Fend., p. 201; Hook. and Bak., Syn. Fil., p. 115; Hemsl., Biol. Cent. Am., vol. III, p. 609; Bak., Jour. Bot., vol. XXII, p. 362 (from Costa Rica).

A. obliquum H & G., Icon. Fil., pl. cxc.

---

[1] Hook. and Bak., Syn. Fil., p. 131. Note under *H. purdieana* Hk.

A. intermedium Swartz,—Hook., Sp. Fil., vol. II, p. 25; Eaton, Fil. Wr. et Fend., p. 202; Hook. and Bak., Syn. Fil., p. 116; Smith, Hist. Fil., p. 275; Smith, Ferns, Brit. and For., p. 184; Hemsl., Biol. Cent. Am., vol. III, p. 609; Bak., Jour. of Bot., vol. XXII, p. 362 (from Costa Rica); Hitch., Pl. Bah., p. 152.

A. triangulatum Kaulf.,—Hook., Sp. Fil., vol. II, p. 26.

A. fovearum Raddi,—Smith, Hist. Fil., p. 275; Smith, Ferns, Brit. and For., p. 184.[1]

The fine series of Nicaragua specimens shows a great variation in division. The fronds are about equally divided between forms with simple pinnæ, and those with the lower one to three pairs of pinnæ compound.

A perfect series connects the extremes.[2] In some specimens one basal pinna only is somewhat compound, while in others there are three lateral pairs of compound pinnæ each with 8 to 10 pairs of pinnules, and between them is an unbroken series of intermediate forms. The once-pinnate fronds have the pinnæ larger than the pinnules of the bi-pinnate forms, but in the intermediate forms with small compound basal pinnæ, the pinnules of what may be regarded as the terminal pinna are large, being like those of some of the once-pinnate fronds.

The roostock is long, slender, about one line in thickness, creeping, and covered with small, lance-linear, acuminate, brown, appressed scales, some of them hair-like. The stipes are ordinarily less than one-half an inch apart. The ultimate divisions vary from broadly obtuse to rather narrowly acuminate. The sterile pinnæ are sometimes cleft.

It will be observed that at least three forms, ordinarily recognized as distinct species, are here grouped together. The simply pinnate forms are usually classed as *A. obliquum*,[3] and *A. kaulfussii*,[4] and the compound forms as *A. intermedium*.[5]

---

[1] As additional references for *A. obliquum* Willd., add: Lieb., Mex. Breg., p. 111; Smith, Ferns, Brit. and For., p. 183.

Under *A. kaulfussii* add: Hitch., Pl. Bah., p. 152.

[2] After the printing of the form immediately preceding these pages, the author decided to still more fully illustrate the forms herein grouped together, and added fig. 2 to pl. V, and plates VII and VIII. Reference should have been made to these on the preceding page.

[3] Pl. VI, figs. 4 and 5.

[4] Pl. V, figs. 5 and 11, and pl. VI., figs. 1 and 2.

[5] Pl. VIII, figs. 1 and 2 are extreme forms; pl. V, figs. 6, 8 and 9, pl. VI,

But the transition from *A. kaulfussii* to *A. obliquum*, and from both of these to *A. intermedium* is so gradual and so complete in the specimens of this collection that no clear line can be drawn between them.

In all of the characters which have heretofore been employed to distinguish between *A. obliquum* and *A. kaulfussii*, there is so much variation in the large series at hand that there seems to be no good reason for separating them.[1]

Most of the specimens are glaucous beneath, with costa less prominent, sori much interrupted, and texture less coriaceous, being typical *A. kaulfussii*. A few specimens are wholly devoid of glaucous bloom, have a distinct costa, and are coriaceous in texture, but in all these characters intermediate forms connect the extremes, the amount of the glaucous bloom, the prominence of the costa and the continuity of the sori being especially variable characters. The pubescence of the stipe is also variable, being sometimes almost wanting.

Fig. 5, Pl. VI represents a pinna of a peculiar form which was found near Camp Menocal. The stipe is smooth, the rachis brown-hairy, the frond once-pinnate, with the pinnæ acuminate, and very obliquely cut at base on the lower side. It is probably var. *major* Hook., figured on Pl. LXXIX A 1, in Hook., Sp. Fil., vol. II.

Both forms, *kaulfussii*, and typical *obliquum* pass gradually into compound forms, the glaucous *kaulfussii* into typical *intermedium*, and *obliquum* into the coarser *triangulatum*. The transition of the lowest pinnæ from simple to compound forms is illustrated by the following figures in the order given: First the simple pinnæ of typical *kaulfussii* as represented in Fig. 5, Pl. V, then Pl. VII, Figs. 1, 2, 3, 4, and Pl. VIII, Figs. 1 and 2.

By a similar series typical *obliquum*, Fig. 4, Pl. VI, passes through intermediate forms of which one is represented in Figs. 3, 4 and 5, Pl. VIII (all from one frond), to a large form

fig. 3, and pl. VII, figs. 1, 2, 3 and 4, represent forms intermediate between typical *A. kaulfussii* and *A. intermedium*.

[1] Baker, Syn. Fil., p. 115, in a note under *A. obliquum* says that they are "very doubtfully distinct."

with three pairs of lateral compound pinnæ, quite like Fendler's No. 414 from Panama,[1] which is marked *A. triangulatum*. This form answers in every respect to Hooker's description of *A. triangulatum* (*ibid.*).

The series being complete all these forms are united under the oldest name, *A. obliquum* Willd. For convenience in reference, however, it may be desirable to recognize *intermedium* as a variety, in which case the name should be written *A. obliquum* Willd. var. *intermedium* Swartz.

The typical form was found rather sparingly in low woods in the vicinity of Castillo. The form *A. kaulfussii* was very common with the type near Castillo, and also along the La Juana River, in both of which localities the forms passing into *intermedium* were also abundant. *A.* "*triangulatum*" was found with typical *obliquum* near Castillo. All of the forms are terrestrial in habit.

A. obliquum has been reported from the vicinity of Granada by Fournier and Hemsley, and *A. kaulfussii*[2] from Chontales by Hemsley (*ibid.*). The form *intermedium* has not heretofore been reported from Nicaragua.[3]

2. A. TRAPEZIFORME L. Pl. VI, Figs. 6–8.

Linne, Syst. Nat., vol. II, p. 695; Swz., Fl. Ind. Occ., p. 125; Presl, Rel. Haenk., p. 63; Presl, Tent. Pter., p. 155, pl. VI, figs. 8, 9, 10; Lieb., Mex. Breg., p. 113; Mett., Fil. Hort. Bot. Lip., p. 48; Hook., Sp. Fil., vol. II, p. 33; Eaton, Fil. Wr. et Fend., p. 202; Roth., Les Foug., vol. I, p. 147, pl. XVI; Hook. and Bak., Syn. Fil., p. 118; Fourn., Sert. Nic., p. 259; Smith, Ferns, Brit. and For., p. 184; Hemsl., Biol. Cent. Am., vol. III, p. 612.

A. pentadactylon L. & S.—Hook. et Grev., Icon. Fil., pl. XCVIII; Smith, Ferns, Brit. and For., p. 184.

This splendid species was found rather sparingly on Ometépe in deep woods and also along a cactus hedge in a banana plantation. It is terrestrial in habit, with a creeping rootstock one-eighth of an inch in diameter, which is densely coated with short, closely-appressed, dark-brown, linear-lanceolate, acuminate scales. The stipes are about one inch apart.

---

[1] Shaw Herbarium, St. Louis.

[2] Fournier, in Sertum Nic., p. 259, refers Levy's no. 496 from Chontales to *A. lucidum* var. *a pinnatum*. Hemsley (*ibid.*) refers it to *A. kaulfussii*.

[3] Hemsley, Biol. Cent. Am., vol. III, p. 609, places *A. lucidum* var. *β pinnatum* Mitt. ex Fourn. Mex. Pl. Enum. i p. 129, in the synonymy of this form. If this is intended for *A. lucidum* var. *β bipinnatum* Mett., it is reported from Chontales by Fournier in Sertum Nic., p. 259.

Reported from the vicinity of Granada by Fournier and Hemsley (*ibid.*).

3. A. CRISTATUM L. Pl. VII, Figs. 6, 7.

Linn., Syst. Nat., vol. II, p. 695; Hook., Sp. Fil., vol. II, p. 46; Eaton, Fil. Wr. et Fend., p. 202; Hook. and Bak., Syn. Fil., p. 118; Hemsl., Biol. Cent. Am., vol. III, p. 608; Smith, Ferns, Brit. and For., p. 184.

A. striatum Willd.,—Fourn., Sertum Nic., p. 259.

Typical specimens of this species were found rather sparingly in the deep woods near Castillo. Hemsley and Fournier (*ibid.*) both report it from Chontales, the latter under the name *A. striatum.*

4. A. TETRAPHYLLUM *Willd.* Pl. VI, Figs. 9–10.

Liebm., Mex. Breg., p. 112; Mett., Fil. Hort. Bot. Lip., p. 47; Hook. and Bak., Syn. Fil., p. 120; Hemsl., Biol. Cent. Am., vol. III, p. 611; Bak., Jour. Bot., vol. XXII, p. 362; Hitch, Pl. Bah., p. 152.

A. prionophyllum H. B. K.—Hook., Sp. Fil., vol. II, p. 21; Eaton, Fil. Wr. et Fend., p. 202; Smith, Ferns, Brit. and For., p. 184.

One specimen only was found in the deep woods near Castillo. It is almost typical, but the pinnules are rather large, and scarcely hairy on the lower surface. The rachises, and to some extent the stipe, are covered with closely appressed brown hairs.

Reported from Chontales by Hemsley (*ibid.*).

5. A. MACROPHYLLUM *Swartz.* Pl. IX, Figs. 1–3.

Swz., Fl. Ind. Occ., p. 1707; Swz., Syn. Fil., p. 122; Presl., Rel. Haenk., p. 60; Hook. et Grev., Icon. Fil., pl. CXXXII; Hook., Sp. Fil., vol. II, p. 3; Lieb., Mex. Breg., p. 111; Mett., Fil. Hort. Bot. Lip., p. 47; Hook., Fil. Ex., pl. LV; Eaton, Fil. Wr. et Fend., p. 201; Hook. and Bak., Syn. Fil., p. 121; Smith, Ferns, Brit. and For., p. 183; Fourn., Sertum Nic., p. 259; Hemsl., Biol. Cent. Am., vol. III, p. 610; Bak., Jour. Bot., vol. XXII, p. 362 (from Costa Rica).

Only two specimens of this beautiful fern were secured. Both were found on rocky banks, one along the San Juan River near Castillo, and the other along the La Juana River.

The latter is once-pinnate, the former has one of the basal pinnæ divided into two pinnules. (See Fig. 1.) Some of the pinnæ are short-stalked.

Reported from Chontales by Fournier and Hemsley (*ibid.*).

6. A. PLATYPHYLLUM *Swartz.* Pl. IX, Figs. 4, 5.

Presl, Tent. Pter., p. 157, pl. VI, fig. 11; Kunze, Analec. Pterid., p. 31, pl. XX; Hook., Sp. Fil., vol. II, p. 3.

A. seemanni Hook., Sp. Fil., vol. II, p. 5, pl. LXXXI A; Eaton, Fil. Wr. et Fend., p. 201; Hook. and Bak., Syn. Fil., p. 121; Hemsl., Biol. Cent. Am., vol. III, p. 611.

The specimens agree exactly with Hooker's figure and description of *A. seemanni*, excepting that one of the fronds has one of the lowest pinnæ compound, with four pinnules, all the others being simple as in Hooker's description. Under his description of *A. seemanni* Hooker says: "Were the sterile pinnules entire, I could almost consider it identical with *A. platyphyllum* of Swartz and Kunze; but I am quite puzzled with Kunze's specimens of '*platyphyllum*,' which...... are *A. kaulfussii*." Kunze evidently distributed some specimens of *A. kaulfussii*, a very distinct species, under the name *A. platyphyllum*. His description and figure, however, very satisfactorily correspond with the Nicaraguan specimens, excepting that the margin of the pinnæ is more deeply serrate in the latter. Kunze, in his figure, represents the margin as very minutely serrulate, and in the text, speaking of the pinnæ, says: "Margine fertili integerrimo; sterili tenuissime crenulato." The size of the serrations in the sterile pinnæ is somewhat variable, and constitutes a character so unsatisfactory in this genus, that specific distinctions cannot be wholly based upon it. For that reason *A. platyphyllum* and *A. seemanni* are united.

Rare, found on a rocky bank of the San Juan River below Castillo. Only four fronds were collected. One of these measures (without the stipe) 13 inches in length, and its stipe is 20 inches long.

This species does not appear in any of the Nicaraguan lists.

7. A. VILLOSUM *L.* Pl. IX, Figs. 6–11.

Linn., Syst. Nat., vol. II, p. 695; Swz., Syn. Fil., p. 124; Lieb., Mex. Breg., p. 112; Hook., Sp. Fil., vol. II, p. 18; Eaton, Fil. Wr. et Fend., p. 202; Hook. and Bak., Syn. Fil., p. 122; Smith, Ferns, Brit. and For., p. 183; Fourn., Sertum Nic., p. 259: Hemsl., Biol. Cent. Am., vol. III, p. 612; Hitch., Pl. Bah., p. 152.

A. acuminatum Desv.,—Fourn., Sertum Nic., p. 259 (placed here on authority of Hemsl., Biol. Cent. Am., vol. III, p. 612).

A. oblique-truncatum Fée,—Fourn., Sertum Nic., p. 259 (placed here by Bak. in Hook. and Bak., Syn., Fil., p. 122, and doubtfully by Hemsley in Biol. Cent. Am., vol. III, p. 612).

The more common form of this species has the frond and stipe each usually less than one foot in length, and pinnules with the lower and outer margins forming a more or less continuous curve. The frond is loose in structure, the pinnules being more or less remote, and there are usually two or three lateral pinnæ on each side. This passes gradually into a larger form with frond and stipe each a foot or more in length, with lateral pinnæ in five or six pairs, the pinnules more closely crowded and the lower and outer margins straight and forming a distinct angle. Both kinds of pinnules are shown in the figures. Nearly continuous and distinctly interrupted sori often appear on the same frond. The rootstock is creeping, two or three lines in diameter, closely covered with appressed, linear, sharply acuminate, brown scales. The stipes are usually not more than a ¼ of an inch apart at base.

Quite common in rather rich soil in the higher deep woods near Moyogalpa on Ometépe. Fournier (*ibid.*) reports it from near Granada, and, as *A. acuminatum*, from Chontales. He also reports *A. oblique-truncatum* from Granada and declares that it is not *A. villosum* L., but *A. villosum* Eaton. Hemsley (*ibid.*) reports it from Chontales.

8. A. PULVERULENTUM *L.* Pl. X, Fig. I.

Linn., Syst. Nat., vol. II, p. 695; Swz., Syn. Fil., p. 124; Lieb., Mex. Breg., p. 113; Hook., Sp. Fil., vol. II, p. 17; Eaton, Fil. Wr. et Fend., p. 202; Hook. and Bak., Syn. Fil., p. 122; Smith, Ferns, Brit. and For., p. 184; Fourn., Sertum Nic., p. 259; Hemsl., Biol. Cent. Am., vol. III, p. 610; Hitch., Pl. Bah., p. 152.

Found sparingly in low, deep woods near Castillo. The specimens are quite typical.

Reported from Chontales by Fournier (*ibid.*).

9. A. CONCINNUM *H. B. K.* Pl. x, Figs. 2–7.

Presl, Rel. Haenk., p. 63; Lieb., Mex. Breg., p. 115; Mett., Fil. Hort. Bot. Lip., p. 48; Hook., Sp. Fil., vol. II, p. 42; Eaton, Fil. Wr. et Fend., p. 202; Roth., Les Foug., vol. I, p. 143, pl. XIV; Fourn., Bull. Soc. Bot. Fr., vol. XVII, p. 236; Hook. and Bak., Syn. Fil., p. 123; Smith, Ferns, Brit. and For., p. 186; Fourn., Sertum Nic., p. 259; Hemsl., Biol. Cent. Am., vol. III, p. 607; Bak., Jour. Bot., vol. XXII, p. 362 (from Costa Rica).

The larger fronds are typical, and the smaller differ only in being bi-pinnate. This fern is terrestrial in habit, with tufted stipes.

Quite common on banks along the shores of Lake Nicaragua on Ometépe, and also occurring sparingly on the inner walls of the old fort at Castillo.

Reported from the vicinity of Granada and from Ometépe by Fournier, and from Ometépe by Hemsley.

10. A. TENERUM *Swartz.* Pl. x, Figs. 8–10.

Swz., Fl. Ind. Occ., p. 1719; Swz., Syn. Fil., p. 125; Presl, Rel. Haenk., p. 63; Lieb., Mex. Breg., p. 115; Mett., Fil. Hort. Bot. Lip., p. 48; Hook., Sp. Fil., vol. II, p. 45; Eaton, Fil. Wr. et Fend., p. 202; Roth., Les Foug., vol. II, p. 43, pl. XII; Hook. and Bak., Syn Fil., p. 124; Smith, Ferns, Brit. and For., p. 186; Eaton, Ferns N. Am., vol. II, p. 231, pl. LXXVII; Fourn., Sertum Nic., p. 259; Underwood, Our Nat. Ferns and Their All., p. 86; Chapm., Fl. So. St., p. 670; Hemsl., Biol. Cent. Am., vol. III, p. 611; Bak., Biol. Cent. Am., vol. IV, p. 115; Hitch., Pl. Bah., p. 152.

The specimens are typical, and occurred sparingly on Ometépe, hanging over a bank by the roadside in deep woods near Moyogalpa.

Reported from Granada by Fournier and Hemsley (*ibid.*).

11. A. DOLOSUM *Kunze var.* WILSONI (*Hook.*) *Bak.* Pl. x, Figs. 11, 12.

Hemsl., Biol. Cent. Am., vol. V, pl. 107.

A. wilsoni Hook., Sp. Fil., vol., II, p. 6, pl. LXXII A; Hook., Fil. Ex., pl. XIV; Smith, Ferns, Brit. and For., p. 183.

A. dolosum Kunze (including var. *wilsoni*),—Hook. and Bak., Syn. Fil., p. 127; Fourn. Sertum Nic., p. 259; Hemsl., Biol. Cent. Am., vol. III, p. 608.

Fine typical specimens of this variety were secured. The pinnæ vary from three to five in number, in well-developed specimens, but young sterile fronds are simple, and vary from ovate-cordate to hastately three-lobed. The bases of the pinnæ vary from somewhat acute through truncate to cordate. Found rather sparingly in the rich soil of higher deep woods near Castillo.

Fournier (*ibid.*) reports *A. dolosum* from Chontales. Whether he includes var. *wilsoni* or not has not been determined. Hemsley (*ibid.*) likewise reports *A. dolosum* (of which *wilsoni* is given as a synonym) from Chontales.

REPORTED SPECIES.

A. lucidum Swartz.

Fourn., Sertum Nic., p. 259 (?), from Chontales; Hemsl., Biol. Cent. Am., vol. III, p. 609, from Chontales.

A. lunulatum Burm.

Fourn., Sertum Nic., p. 258, as *lunulatum* and *dolabriforme* Hook., the first without locality, the latter from Granada; Hemsl., Biol. Cent. Am., vol. III, p. 610, from the vicinity of Granada.

Family II. **LINDSAYEÆ.**

Genus DICTYOXIPHIUM *Hooker.*

1. D. PANAMENSE *Hook.* Pl. X, Figs. 13–16.

Hook., Sp. Fil., vol. I, p. 224; Mett., Üb. Ein. Farng., part III, p. 6 (note), pl. XVI, figs. 18, 19 (sections); Roth., Les Foug., vol. II, p. 85, pl. XXXI; Hook. and Bak., Syn. Fil., p. 113; Smith, Ferns, Brit. and For., p. 133 (fig.); Fourn. Sertum Nic., p. 259; Hemsl., Biol. Cent. Am., vol. III, p. 606.

Lindsæa (*Dicty.*) *Panamensis* Mett.,—Eaton, Fil. Wr. et Fend., p. 213.

A fine series of typical specimens was collected near Castillo. The sterile fronds are mostly shorter, and much broader than the fertile fronds, and are more or less glaucous on the lower surface, especially when young. Linear-lanceolate dark-brown scales (see figure) are scattered on the short stipe and on both sides of the mid-rib near the base, being much denser on the stipe and gradually diminishing in size and number upward.

The sori are often interrupted toward the base as represented in Figure 16.

The fern is terrestrial in habit, growing in scattered tufts in deep woods.

Fournier and Hemsley (*ibid.*) report it from Chontales.

Genus LINDSAYA[1] *Dry.*

1. L. TRAPEZIFORMIS *Dry.* Pl. XI, Figs. 1–7.

Swz., Syn. Fil., p. 119; Hook., Sp. Fil., vol. I, p. 214; Eaton, Fil. Wr. et Fend., p. 213; Hook. and Bak., Syn. Fil., p. 107; Smith, Ferns, Brit. and For., p. 230; Hemsl., Biol. Cent. Am., vol. III, p. 606; Bak., Biol. Cent. Am., vol. IV, p. 115 (from Costa Rica).

L. leprieurii Hook., Sp. Fil., vol. I, p. 208, pl. LXII D.

Baker and Hemsley (*ibid.*) also place *L. horizontalis* Hook. in the synonymy of this species. It may be that *L. trapeziformis* has been made the common dumping-ground of too many forms, yet a comparison of the various descriptions indicates the possibility of the necessity of the union under this name of the two species herein listed. The material at hand, however, is not sufficient to decide this. There certainly is a wide gap between the two forms here recognized as distinct species.

Only seven fronds of this species were collected. Of these four are small (though fruiting), once-pinnate, and closely resemble Hooker's figure of *L. leprieurii;* two have a large lateral pinna or division at the base on one side; and one is compound with two lateral pinnæ on each side. In all the fronds the stipes and rachises are brown, square (sometimes even slightly four-winged), and with the terminal pinnæ (or pinnules) sub-rhomboidal, and very different from the terminal pinnules of the following species, as is shown in Plate VIII.

Hooker's description of *L. trapeziformis* accurately defines the Nicaraguan specimens.

---

[1] More frequently written *Lindsæa.* The author has no means at hand to determine which should be accepted, and hence follows the comparatively recent works of Baker and Hemsley.

Terrestrial, the fronds occurring in scant tufts in the deep woods near Camp Menocal.

Not heretofore specifically reported from Nicaragua.

2. L. HORIZONTALIS *Hook.* Pl. XI, Figs. 8–11.

Hook., Sp. Fil., vol. I, p. 214, pl. LXII B; Eaton, Fil. Wr. et Fend., p. 213.

The two specimens which are referred to this species agree in every detail with the description and figure given by Hooker. As has already been stated it may be necessary to unite this with the preceding species, but the distinction between the Nicaraguan specimens is well-marked. The specimens referred to *L. horizontalis* are larger, more divided, with pale and more slender stipe, and paler, thinner, smaller pinnules. The difference in the apices, as shown by the figures, is marked, and is also constant in the set in the Herbarium of the Missouri Botanical Garden, St. Louis. One of the fronds is about 18 inches long, and has a stipe 1 foot in length. It has nine pairs of lateral pinnæ which gradually diminish in length toward the tip of the frond. The terminal pinna is small. The other frond is smaller and has but two pairs of lateral pinnæ. Both specimens closely resemble Wright's Cuban specimen No. 976 in the Herbarium of the State University. Of Wright's No. 976 Eaton[1] says that it is in part *L. trapeziformis* and in part *L. horizontalis.*

Growing on the trunk of a tree in the deep woods near Camp Menocal.

Not heretofore reported from Nicaragua.

Family III. DAVALLIEÆ.

Genus DAVALLIA *Smith.*

1. D. SACCOLOMA *Spreng.* Pl. XI, Fig. 12; Pl. XII, Figs. 1–4.

Hook., Sp. Fil., vol. I, p. 170; Eaton, Fil. Wr. et Fend., p. 212; Hook. and Bak., Syn. Fil., p. 97; Hemsl., Biol. Cent. Am., vol. III, p. 605.

Saccoloma elegans Kaulf.,—Kunze, Farrn., p. 85, pl. XLI; Smith, Ferns, Brit. and For., p. 235.

---

[1] Fil. Wr. et Fend., p. 213.

This species has the margin of the pinnæ more or less reflexed over the sori, or at least curved downward so that a double involucre is seemingly formed, and consequently approaches the sub-genus *Pæsia* of *Pteris*, or *Isoloma* of *Lindsaya.* It also simulates some of the once-pinnate forms of the sub-genus *Eupteris* in venation, texture and division. Its right to a place in the genus *Davallia* is somewhat questionable.

The fronds are from 2 to more than 4 feet in length, dark-green, lance-ovate, and with brown stipes which are roughened with scattered tubercles or short spines. The bases of the pinnæ vary from short-cuneate and equal, to decidedly unequal, the upper side in the latter forms being more rounded, and extending nearer to the rachis. The upper pinnæ are sessile and often slighty decurrent on the rachis, the lower are short-stalked.

2. D. INEQUALIS *Kunze.* Pl. XII, Figs. 5, 6.

Hook., Sp. Fil., vol. I, p. 180, pl. LVII B; Eaton, Fil. Wr. et Fend., p. 212; Hook. and Bak., Syn. Fil., p. 99; Hemsl., Biol. Cent. Am., vol. III, p. 605; Bak., Biol. Cent. Am., vol. IV, p. 115 (from Costa Rica).

Microlepia inequalis Presl, Tent. Pter., p. 125.

The largest fronds which were observed measured 2½ feet in length. The stipes are smooth, light-brown. Hooker's figure exactly represents the Nicaraguan specimens.

Terrestrial in habit. Not rare in the deep woods near Camp Menocal.

New to the Nicaraguan list.

Family IV. DICKSONIEÆ.

Genus DICKSONIA *L'Hérit.*

1. D. ADIANTOIDES *H. B. K.* Pl. XII, Figs. 7, 8.

Presl, Rel. Haenk., p. 67; Hook., Sp. Fil., vol. I, p. 75, pl. XXVI B; Lieb., Mex. Breg., p. 111; Eaton, Fil. Wr. et Fend., p. 214; Hook. and Bak., Syn. Fil., p. 52; Hemsl., Biol. Cent. Am., vol. III, p. 596.

D. erosa Kunze,—Hook., Sp. Fil., vol. I, p. 75.

Sitolobium adiantoides Smith, Ferns, Brit. and For., p. 236.

Baker[1] says that *D. obtusifolia* Willd. is the oldest name. If this can be clearly established, *i. e.*, if *D. obtusifolia* and *D. adiantoides* are really identical, the former name should stand. Hooker[2] however, places *D. obtusifolia* among the doubtful species, but suggests its close relationship to *D. adiantoides*.

The specimens are quite typical. The rachises and lower surface of the frond are, however, scurfy with minute scales rather than hairy. The involucre is occasionally quite two-lipped, the inner lip over-lapping, the species thus approaching the sub-genus *Eudicksonia*. The pinnæ near the apex of the frond are once-pinnate or merely pinnatifid. The apices of the pinnules vary from broadly obtuse to acuminate. The fronds are 2 to 3 feet long, rather broadly triangular, with the stipe and rachis brownish.

Terrestrial in habit. Not common, in woods near Camp Menocal.

There seems to be no previous record of the occurrence of this species in Nicaragua.

2. D. RUBIGINOSA *Kaulf.* Pl. XII, Fig. 10; Pl. XIII, Figs. 1, 2.

Hook., Sp. Fil., vol. I, p. 79, pl. XXVII A; Lieb., Mex. Breg., p. 110; Mett., Fil. Hort. Bot. Lip., p. 106; Eaton, Fil. Wr. et Fend., p. 213; Hook. and Bak., Syn. Fil., p. 53; Hemsl., Biol. Cent. Am., vol. III, p. 597; Bak., Biol. Cent. Am., vol. IV, p. 115; Bak., Jour. Bot., vol. XXII, p. 362 (the two last from Costa Rica).

D. dissecta Hook., Sp. Fil., vol. I, p. 77.

D. anthriscifolia Kaulf.,—Hook., Sp. Fil., vol. I, p. 79, pl. XXVII B.

Sitolobium rubiginosa Smith, Ferns, Brit. and For., p. 237.

A handsome species which was rather common in the deep woods near Castillo, chiefly on higher ground. Some of the plants were arborescent with a stem 1½ feet high and 1 to 1½ inches in diameter, densely covered with black, sharp, straight spines, some of which seem to be modified roots. Other specimens in full fruit were acaulescent.

The stipe, rachis and larger secondary rachises are aculeate with sharp spines which are brownish or straw-colored like the rachis. The spines diminish in number upward, and the terminal portions of the rachises are tomentose only. On the main rachis the tomentum is restricted to the groove on the upper side.

---

[1] In Hook. and Bak., Syn. Fil., p. 52.

[2] Sp. Fil., vol. I, p. 81.

No mention is made of the spines in any of the accessible descriptions, though Baker[1] says that the rachises are "slightly asperous."

The white jointed hairs are scattered over the lower surface of the frond, though most abundant along the midribs.

Hooker's figures in all respects accurately represent the specimens in the collection. The latter, however, are more delicate than most of the specimens examined by the author, resembling closely Pringle's Mexican specimens in the Shaw Herbarium at St. Louis. Not heretofore reported from Nicaragua, though listed by Baker (*ibid.*) from neighboring Costa Rica.

REPORTED SPECIES.

D. cicutaria Swartz.

Hemsl., Biol. Cent. Am., vol. III, p. 596, without exact locality.

Dennstædtia ordinata Fourn., Sertum Nic., p. 260, without exact locality.

Family V. **BLECHNEÆ.**

Genus LOMARIA *Willd.*

This genus is intermediate between *Pterideæ* and *Blechnum*, and has quite as good a right to a place in the former. No specimens were collected, but note is made of the following

REPORTED SPECIES:

L. onocleoides Spreng.

Fourn., Sertum Nic., p. 258; Hemsl., Biol. Cent. Am., vol. III, p. 626; both from Chontales.

Genus BLECHNUM *Linn.*

1. B. LONGIFOLIUM *H. B. K.* Pl. XIII, Figs. 3, 4.

Mett., Fil. Hort. Bot. Lip., p. 62; Eaton, Fil. Wr. et Fend., p. 204; Hook.,

---

[1] Hook. and Bak., Syn. Fil., p. 53, note under *D. rubiginosa*.

Sp. Fil., vol. III, p. 49; Hook. and Bak., Syn. Fil., p. 185; Hemsl., Biol. Cent. Am., vol. III, p. 627.

B. gracile Kaulf.,—Mett., Fil. Hort. Bot. Lip., p. 62; Hook., Sp. Fil., vol. III, p. 48; Fourn., Sertum Nic., p. 258; Smith, Ferns, Brit. and For., p. 198; Bak., Jour. Bot., vol. XXII, p. 362 (from Costa Rica.).

B. intermedium Link.,—Kunze, Farrnk., p. 128, pl. LVII, fig. 2; Mett., Fil. Hort. Bot. Lip., p. 62; Lieb., Mex. Breg., p. 86; Hook., Sp. Fil., vol. III, p. 47; Smith, Ferns, Brit. and For., p. 198.

The four fronds in the collection are nearest to the form *gracile*, but in the size of the terminal pinna (3½ to 4½ inches in length), and in the almost total absence of serrations on some of the pinnæ they approach *intermedium* as described by Hooker and figured by Kunze (*ibid.*).

Each of the specimens has three pairs of lateral pinnæ. These vary from ¾ to 2 inches in length, and are sessile, or very short-stalked. The stipes were flesh-colored when fresh, drying to a light-brown color.

Not common, growing on wet rocks below the lower falls of the Deseado River at the eastern base of the Divide.

Hemsley reports it from Chontales.

Another form, var. *fraxineum*, is reported from Costa Rica by Baker[1]

2. B. OCCIDENTALE *L.*

Linn., Syst. Nat., vol. II, p. 688; Swz., Syn. Fil., p. 113; Presl, Rel. Haenk., p. 49; Lieb., Mex. Breg., p. 86; Mett., Fil. Hort. Bot. Lip., p. 62, pl. III, fig. 8; Eaton, Fil. Wr. et Fend., p. 204; Hook., Sp. Fil., vol. III, p. 50; Fourn., Bull. Soc. Bot. Fr., vol. XVII, p. 236; Fourn., Sertum Nic., p. 258; Hook. and Bak., Syn. Fil., p. 185; Smith, Ferns, Brit. and For., p. 197; Hemsl., Biol. Cent. Am., vol. III, p. 628; Bak., Jour. Bot., vol. XXII, p. 362 (from Costa Rica); Hitch., Pl. Bah., p. 153.

B. aduncum Lieb., Mex. Breg., p. 85.

Typical specimens of this species were rather common in rocky soil at the base of the volcano Ometépe, and near the foot of the hill on which old Ft. Castillo stands. A smaller form with fronds ¾ to 1¾ inches wide, with rachis hairy beneath, and obtuse pinnæ sometimes cuspidate, was found on the volcano Ometépe at an altitude of about 4,000 feet.

Hemsley reports it from Chontales and Granada, and Fournier from Chontales, Granada and Ometépe.

---

[1] Biol. Cent. Am., vol. IV, p. 116.

3. B. VOLUBILE *Kaulf.*

Kunze, Analec. Pter., p. 20, pl. XIII; Mett., Fil. Hort. Bot. Lip., p. 63; Eaton, Fil. Wr. et Fend., p. 205; Hook., Sp. Fil., vol. III, p. 62; Hook. and Bak., Syn. Fil., p. 187; Bak., Biol. Cent. Am., vol. IV, p. 115.

Salpichlæna volubile Smith, Ferns, Brit. and For., p. 209.

The vine-like fronds of this splendid fern often climb in clusters to a height much exceeding 25 feet. As only the uppermost pinnæ were fruiting it was exceedingly difficult to secure fertile specimens, only two of which are in the collection. The specimens which were observed were typical, but alternate pinnæ were not rare.

Common in deep woods near Castillo and Camp Menocal. Not heretofore reported from Nicaragua.

Family VI. ASPLENIEÆ.

Genus ASPLENIUM *Linn.*

1. A. SERRATUM *L.*

Linn., Syst. Nat., vol. II, p. 689; Swz., Syn. Fil., p. 74; Hook., Fil. Ex., pl. LXX; Mett., Üb. Ein. Farng., pt. VI, p. 88; Eaton, Fil. Wr. et Fend., p. 205; Hook., Sp. Fil., vol. III, p. 81; Hook. and Bak., Syn. Fil., p. 193; Smith, Ferns, Brit. and For., p. 209; Eaton, Ferns N. Am., vol. I, p. 17, pl. III; Fourn., Sertum Nic., p. 257; Underwood, Our Nat. Ferns and All., p. 97; Hemsl., Biol. Cent. Am., vol. III, p. 639; Bak., Biol. Cent. Am., vol. IV, p. 116 (from Costa Rica); Chapm., Fl. So. St., p. 671.

A. crenulatum Presl, Tent. Pter., p. 106.

Common on trees in deep woods near Castillo and near Camp Seven. The fronds were tufted, from short scaly clustered rootstocks. The specimens are typical, but some of them form obtuse lobes toward the apex of the frond.

Hemsley and Fournier both report it from Chontales.

2. A. ALATUM *H. B. K.* Pl. XIII, Figs. 5–7.

Hook., Icon. Fil., pl. CXXXVII; Mett., Fil. Hort. Bot. Lip., p. 72; Mett., Üb. Ein. Farng., pt. VI, p. 119; Eaton, Fil. Wr. et Fend., p. 205; Hook., Sp. Fil., vol. III, p. 121; Hook. and Bak., Syn. Fil., p. 200; Smith, Ferns, Brit. and For., p. 213.

A. pterophorum Presl, Tent. Pter., p. 107.

Rather rare in the deep woods near Castillo. None of the fronds are distinctly proliferous, but only one has a perfect apex, figured in Fig. 7, Pl. XIII. The wings are prominent on both rachises and stipes, and in most of the fronds the pinnæ are unequally developed, giving the frond a ragged appearance. Forking veins are rare in all of the specimens.

New to Nicaragua. The species is not mentioned in the *Biologia Centrali-Americana.*

3. A. LUNULATUM *Swz.* var. PROLIFERUM (*Swz.*) *Mett.* Pl. XIII, Fig. 8; Pl. XIV, Fig. 1.

Mett., Üb. Ein. Farng., pt. VI, p. 121.

A. lunulatum Swartz,[1]—Bak., On Rec. Syn. Braz. F., p. 21; Hook. and Bak., Syn. Fil., p. 202; Hemsl., Biol. Cent. Am., vol. III, p. 636; Bak., Biol. Cent. Am., vol. IV, p. 116 (from Costa Rica).

A. erectum Bory,[2]—Lieb., Mex. Breg., p. 90; Mett., Fil. Hort. Bot. Lip., p. 73; Eaton, Fil. Wr. et Fend., p. 205; Fourn., Sertum Nic., p. 257.

A. proliferum Swartz, Fl. Ind. Occ., p. 1609; Swz., Syn. Fil., p. 74; Mett., Fil. Hort. Bot. Lip., p. 74, pl. XI, fig. 7.

A. erectum var. *proliferum* Hook., Fil. Ex., pl. LXXII; Hook., Sp. Fil., vol. III, p. 126.

A. tenellum Roxb.,—Smith, Ferns, Brit. and For., p. 212.

Not common in the deep woods near Camp Menocal. Terrestrial in habit, growing in tufts.

The specimens are very similar to Hooker's[3] figure, the stipes in the former, however, being much shorter. The pinnæ vary from broadly obtuse to obtusely acuminate at the apex. The apices of most of the fronds are broken off, but some were evidently proliferous. Fig. 8, Pl. XIII represents a perfect apex which is not proliferous. Hemsley reports *A. lunulatum* from Chontales, and Fournier gives *A. erectum* from the same locality. Whether these include the var. *proliferum* or not does not appear in the references.

The variety has not heretofore been specifically reported from Nicaragua.

---

[1] Probably including var. *proliferum.*

[2] Probably including var. *proliferum.*

[3] Fil. Exot., pl. LXXII.

4. A. CULTRIFOLIUM *L.* Pl. XIV, Figs. 2–4.

Linn., Syst. Nat., vol. II, p. 690; Swz., Syn. Fil., p. 78; Mett., Üb. Ein. Farng., pt. VI, p. 98; Hook., Sp. Fil., vol. III, p. 110; Hook. and Bak., Syn. Fil., p. 203; Hemsl, Biol. Cent. Am., vol. III, p. 632; Bak., Jour. Bot., vol., XXII, p. 362 (from Costa Rica).

There is considerable variation in the form and length of the pinnæ, and in the character of the serrations, the teeth in some specimens being simple, in others distinctly bifid. These differences are shown in the figures.

The sori in most of the fronds are simple, a few pinnæ only showing the diplazioid character.

The stipes are tufted, from a short, erect rootstock one-eighth of an inch in diameter. The rootstock appears thicker, however, because it is covered with the bases of old stipes.

Common in rich soil in deep woods near Castillo.

Not heretofore reported from Nicaragua.

5. A. SERRA *L. and F.* Pl. XIV, Figs. 5, 6.

Lieb., Mex. Breg., p. 94; Mett., Fil. Hort. Bot. Lip., p. 76; Mett., Üb. Ein. Farng., pt. VI, p. 151; Eaton, Fil. Wr. et Fend., p. 205; Hook., Sp. Fil., vol. III, p. 154; Hook. and Bak., Syn. Fil., p. 206; Hemsl., Biol. Cent. Am., vol, III, p. 638; Bak., Biol. Cent. Am., vol. IV, p. 116 (from Costa Rica).

A. pœppigii Presl, Tent. Pter., p. 106, pl. III, fig. 21.

A. insigne Lieb., Mex. Breg., p. 94.

Typical specimens were not rare on trunks of trees near Camp Menocal, though but few were collected.

The lower pinnæ are sometimes auricled at the base on the upper side. The rachis is usually at first covered with small, linear, dark-brown, appressed, deciduous scales.

Reported from Realejo by Hooker[1] and Hemsley, and from Nicaragua without locality by Hemsley.

6. A. AURITUM *Swartz.* Pl. XIV, Figs. 7, 8.

Swz., Fl. Ind. Occ., p. 1616; Swz., Syn. Fil., p. 78; Presl, Rel. Haenk., p. 43; Lieb., Mex. Breg., p. 96; Mett., Fil. Hort. Bot. Lip., p. 73; Mett., Üb. Ein. Farng., pt. VI, p. 103; Eaton, Fil. Wr. et Fend., p. 206; Hook., Sp. Fil., vol. III, p. 178; Roth., Les Foug., vol. I, p. 167, pl. XXVI; Bed.,

---

[1] Sp. Fil., vol. III, p. 155.

Ferns S. Ind., p. 47, pl. cxxxvii; Hook. and Bak., Syn. Fil., p. 208; Smith, Ferns, Br. and For., p. 217; Hemsl., Biol. Cent. Am., vol. iii, p. 630; Bak., Biol. Cent. Am., vol. iv, p. 362 (from Costa Rica).

A. monodon Lieb., Mex. Breg., p. 96.

The specimens are typical according to Hooker (*ibid.*).

The pinnæ vary from almost entire to deeply serrate with or without auricle, and the rachis is very narrowly winged. The stipe is often almost black near the base and gradually changes to green upward. The rachis is green, sometimes blackish below.

Common in rather open woods (a partial clearing) near Castillo growing both on tree-trunks and on the ground. Also found along the Deseado River near Camp Menocal, on tree-trunks.

New to the Nicaraguan list.

7. A. FORMOSUM *Willd.* Pl. xiv, Figs. 9, 10.

Presl, Rel. Haenk., p. 44; Lieb., Mex. Breg., p. 89; Hook., Fil. Ex., pl. xvi; Mett., Üb. Ein. Farng., pt. vi, p. 134; Eaton, Fil. Wr. et Fend., p. 205; Hook., Sp. Fil., vol. iii, p. 143; Fourn., Bull. Soc. Bot. Fr., vol. xvii, p. 236; Hook. and Bak., Syn. Fil., p. 210; Smith, Ferns, Brit. and For., p. 212; Fourn., Sertum Nic., p. 257; Hemsl., Biol. Cent. Am., vol. iii, p. 633; Bak., Jour. Bot., vol. xxii, p. 362.

A. subalatum H. and A.,—Fourn., Sertum Nic., p. 257 (from Granada).

Nearly typical, but rather narrow, and with very few specimens showing sori on the upper side of the midrib.

Found sparingly on rocky banks near the foot of the volcano Ometépe, and along the Los Sabalos River.

Reported from Chontales and Granada by Fournier and Hemsley.

8. A. LÆTUM *Swartz.* Pl. xv, Figs. 1–5.

Swz., Syn. Fil., pp. 79, 271; Eaton, Fil. Wr. et Fend., p. 205; Hook., Sp. Fil., vol. iii, p. 133, pl. clxxiii; Roth., Les Foug., vol. ii, p. 118, pl. xlvi; Hook. and Bak., Syn. Fil., p. 210; Hemsl., Biol. Cent. Am., vol. iii, p. 635.

A. schkuhrianum Presl, Tent. Pter., p. 107.

Great confusion exists in the synonymy of this species. Hooker (*ibid.*) says: “ We have, unfortunately, no means of ascertaining the exact species intended by Swartz for his *Aspl. lætum*." Schkuhr, according to the same authority, "gives a figure of *A. lætum*, which appears sufficiently to accord with Swartz's description." To this Presl later gave the name *A. schkuhrianum*. That this is really the same as Swartz's *A. lætum* is by no means certain, and it may be necessary to adopt Presl's name, *A. schkuhrianum*, if indeed the whole vexed question of synonymy in this case will not be settled by referring this to *A. resectum* Smith, as has been suggested by Baker.[1] Certainly judging from the descriptions and figures of *A. resectum* to which the author had access, and from the variation in the form of the pinnæ and in the character of the rootstock in the Nicaraguan specimens, there is no constant difference between *A. resectum* and *A. lætum*. Hooker[2] says of *A. lætum*: "Its nearest affinity is unquestionably with the *A. resectum* of Sir James Smith, an Oriental plant, whose long creeping caudex at once distinguishes it." Baker (*ibid.*), comparing *A. lætum* with *A. resectum*, says of the former: "The texture is usually firmer and the pagina is more developed on the lower side of the midrib." Hooker's plate[3] of *A. resectum*, but for the remoteness of the stipes, accurately represents some forms in the collection.

But for the doubt which exists concerning the variation in texture and in the arrangement of the stipes on the rootstock, which cannot be removed because of a lack of authentic series of *A. resectum*, the author would include *A. lætum* in *A. resectum*.

The specimens all have dull green rachises (like some forms of *resectum*), and most of them have the lowest pair of pinnæ deflexed,—a character generally possessed by *lætum*.

There is much variation in the character of the upper basal portion of the pinnæ. In some specimens there is no distinct auricle, others are auriculate, and in still others the division is carried to the extent represented in Fig. 1, Pl. XV.

---

[1] In Hook. and Bak., Syn. Fil., p. 210, in note under *A. lætum*.

[2] Sp. Fil., vol. III, p. 134, in note under *A. lætum*.

[3] Icon. Fil., pl. CXIV.

Quite common on rocky banks of a small stream in deep woods near Castillo.

Reported by Hooker and Hemsley from Realejo.

9. A. PUMILUM *Swartz.* Pl. xv, Fig. 6.

Swz., Fl. Ind. Occ., p. 1610; Swz., Syn. Fil., p. 76; Lieb., Mex. Breg., p. 95; Mett., Fil. Hort. Bot. Lip., p. 75; Mett., Üb. Ein. Farng., pt. VI, p. 127; Eaton, Fil. Wr. et Fend., p. 206; Hook., Sp. Fil., vol. III, p. 174; Hook. and Bak., Syn. Fil., p. 212; Smith, Ferns, Br. and For., p. 213; Hemsl., Biol. Cent. Am., vol. III, p. 637; Bak., Jour. Bot., vol. XXII, p. 362 (from Costa Rica).

A. heterophyllum Presl, Rel. Hænk., p. 40.

Typical specimens of this well-marked species were rather common in coarse volcanic soil at the foot of the volcano Ometépe.

Not heretofore specifically credited to Nicaragua.

10. A. PLANTAGINEUM *L.*

Linn., Syst. Nat., vol. II, p. 689; Mett., Fil. Hort. Bot. Lip., p. 74; Mett., Üb. Ein. Farng. pt. VI, p. 161; Eaton, Fil. Wr. et Fend., p. 206; Hook., Sp. Fil., vol. III, p. 237; Hook. and Bak., Syn. Fil., p. 230; Fourn., Sertum Nic., p. 257; Hemsl., Biol. Cent. Am., vol. III, p. 637.

Diplazium plantagineum Swartz, Syn. Fil., p. 91, pl. II, fig. 4; Presl, Tent. Pter., p. 113, pl. IV, fig. 1; Lieb., Mex. Breg., p. 100; Smith, Ferns, Brit. and For., p. 222.

This well-marked species was quite rare in the deep woods near Castillo. The fronds are quite typical, but are coarsely serrate toward the apex, and show a disposition to become coarsely toothed or slightly lobed toward the base.

The rootstock is short-creeping, and is covered with copious, dark-brown, wiry roots which penetrate into the soil to considerable depth.

Reported from Chontales by Fournier and Hemsley.

11. A. CELTIDIFOLUM *Kunze.* Pl. xv, Fig. 6.

Mett., Fil. Hort. Bot. Lip., p. 75, pl. XII, figs. 3 and 4; Mett., Üb. Ein. Farng., pt. VI, p. 178; Eaton, Fil. Wr. et Fend., p. 206; Hook., Sp. Fil., vol. III, p. 240; Hook. and Bak., Syn. Fil., p. 232.

Owing to an accident only two pinnæ remain of the specimens which are referred with some doubt to this species.

These pinnæ are more deeply lobed than many others which were collected. The latter resemble Fendler's No. 141 from Trinidad, in the Shaw Herbarium, quite closely. It is not improbable that these pinnæ belong to what Hooker[1] has called *A. ottonis* var. β (?). The stipe when fresh, is thick, greenish, spotted with purple, and hollow. The fronds were 2 to 3 feet long.

Not rare on moist banks along the La Juana River.

Not reported from Nicaragua. Baker in *Synopsis Filicum*, gives the distribution from "Cuba and Columbia to Ecuador and Brazil."

12. A. SYLVATICUM *Presl.* Pl. XV, Fig. 7; Pl. XVI, Figs. 1, 2.

Presl, Rel. Hænk., p. 42; Mett., Üb. Ein. Farng., pt. VI, p. 179; Hook., Sp. Fil., vol. III, p. 248; Bed., Ferns of S. Ind., p. 53, pl. CLXI; Hook. and Bak., Syn. Fil., p. 232; Hemsl., Biol. Cent. Am., vol. III, p. 640; Bak., Jour. Bot., vol. XXII, p. 362.

Diplazium sylvaticum Swartz,—Smith, Ferns, Br. and For., p. 223.

A. mutilum Kunze,—Mett., Üb. Ein Farng., pt. VI, p. 180; Hook., Sp. Fil., vol. III, p. 248.

A. ottonis Klotz.,—Eaton, Fil. Wr. et Fend., p. 206; Hook., Sp. Fil., vol. III, p. 243.

The diplazoid species of *Asplenium*, of the group of which *A. grandifolium* is a type, are in a sad state of confusion. The shape of the base and the division of the margin of the pinnæ, together with the venation and the length and position of the sori,—characters on which the species are chiefly based,—are all so variable that they are extremely unsatisfactory. It is probable that a more thorough study of large series will necessitate the union of this and other related forms with *A. grandifolium* Swartz. The only reasonably satisfactory distinction is in the form of the base of the pinnæ being wedge-shaped or rounded in the latter, and truncate or cordate in the former. But some variation is shown even in this character, and the value of most of the species of the group is extremely uncertain. The specimens in the collection are *A. ottonis*, but this is no doubt rightfully referred to *A. sylvaticum* by Baker.

---

[1] Sp. Fil., vol. III, p. 243.

This species was not very rare, growing in tufts to a height of 1 to 1½ feet, in rich soil in deep woods near Castillo.

Baker and Hemsley report it from Costa Rica, the only records of the species under this name in America. It is known, however, as *A. ottonis* from several American localities.

13. A. SHEPHERDI *Spreng.* Pl. XVI, Figs. 3. 4.

Mett., Fil. Hort. Bot. Lip., p. 75; Mett., Üb. Ein. Farng., pt. VI, p. 164; Hook. and Bak., Syn. Fil., p. 233; Hemsl., Biol. Cent. Am., vol. III, p. 639; Bak., Jour. Bot., vol. XXII, p. 116.

Diplazium shepherdi Smith, Ferns, Brit. and For., p. 222.

Diplazium striatum Presl, Tent. Pter., p. 114.

A. caracasanum Mett., Üb. Ein. Farng., pt. VI. p. 165, pl. V, fig. 17.

A. striatum L.,[1]—Hook., Sp. Fil., vol. III, p. 245.

A .denticulosum Desv.,—Fourn., Sertum Nic., p. 258.

But two fronds were collected, though the species was not rare along the Deaseado River.

Both of these are slender, and rather weak, in this respect, and in the division of the pinnæ being the var. *caracasanum*. One of the fronds also has the usual sori of *caracasanum*. Terrestrial in habit.

Fournier reports this as *A. denticulosum* from Chontales, and on his authority it is also reported by Hemsley under *A. shepherdi*.

14. A. RADICANS *Schk.* Pl. XVI, Figs. 5, 6.

Swz., Syn. Fil., p. 84; Hook., Sp. Fil., vol. III, p. 26 (in part); Hook. and Bak., Syn. Fil., p. 241; Hemsl., Biol. Cent. Am., vol. III, p. 637; Bak., Biol. Cent. Am., vol. IV, p. 116 (both from Costa Rica).

A. ambiguum Raddi (?),—Fourn., Sertum Nic., p. 257.

Quite abundant in the deep woods on higher ground near Castillo. The fronds were tufted. Terrestrial in habit.

Reported probably as *ambiguum* (?) by Fournier from Nicaragua without locality.

15. A. MARGINATUM *L.*

Linn., Syst. Nat., vol. II, p. 690; Lieb., Mex. Breg., p. 100; Mett., Fil. Hort.

---

[1] Probably *A. striatum* Linn., Syst. Nat., vol. II, p. 600 (also Swz., Syn. Fil., p. 82; Mett., Üb. Ein. Farng., pt. VI, p. 185) should be placed here. If this were certain this name would have precedence.

Bot. Lip., p. 71; Hook., Fil. Ex., pl. LXXIII; Mett., Üb. Ein. Farng., pt. VI, p. 170; Eaton, Fil. Wr. et Fend., p. 206; Hook., Sp. Fil., vol. III, p. 271; Hook. and Bak., Syn. Fil., p. 246; Hemsl., Biol. Cent. Am., vol. III, p. 636.

Hemidictyum marginatum Presl, Tent. Pter., p. 113, pl. III, fig. 24; Roth., Les Foug., vol. II, p. 63, pl. XXI; Smith, Ferns, Br. and For., p. 228.

This well-marked species was rare in the deep, low woods near Castillo. Terrestrial in habit.

Reported from Chontales by Hemsley.

(A sterile specimen of what seems to be an *Asplenium* was collected near Camp Menocal. It resembles *A. rhizophyllum* Kunze, but the lowest pinnæ are the longest and most compound, making the frond sub-deltoid. Young fronds of *rhizophyllum* in the Shaw Herbarium, however, show a tendency in the same direction, and the Nicaraguan specimen probably belongs to this species. If so it is new to the Nicaraguan list. It may, however, be a small form of *A. cicutarium* Swartz. This is reported from Chontales by both Fournier and Hemsley.[1])

REPORTED SPECIES.

A. abscissum Willd.

Fourn., Sertum Nic., p. 257, from Chontales.

A. anisophyllum Kunze.

Fourn., Sertum Nic., p. 257; Hemsl., Biol. Cent. Am., vol. III, p. 630; both from Chontales.

A. callipteris (Fée) Bak.

Fourn., Sertum Nic., p. 258; Hemsl., Biol. Cent. Am., vol. III, p. 631; both from Chontales.

A. cicutarium L.

Fourn., Sertum Nic., p. 257, without locality; Hemsl., Biol. Cent. Am., vol. III, p. 632, from Chontales.

A. fournieri Kuhn.

Fourn., Bull. Soc. Bot. Fr., vol. XVII, p. 237, from Ometépe; Fourn., Sertum Nic., p. 257; Hemsl., Biol. Cent. Am., vol. III, p. 634; the two latter from Ometépe and Granada.

---

[1] See *A. cicutarium* under "Reported Species."

A. *grandifolium* Swartz.

Fourn., Sertum Nic., p. 258; Hemsl., Biol. Cent. Am., vol. III, p. 634; both from Chontales.

A. *kunzei* Mett.

Fourn., Sertum Nic., p. 258; Hemsl., Biol. Cent. Am., vol. III, p. 635; both from Chontales.

A. *levyi* Fourn.

Fourn., Sertum Nic., p. 257; Hemsl., Biol. Cent. Am., vol. III, p. 635; both from Chontales.

A. *lindbergii* Mett.

Fourn., Sertum Nic., p. 258; Hemsl., Biol. Cent. Am., vol. III, p. 635; both from Chontales.

A. *monanthemum* L.

Hook., Sp. Fil., vol. III, p. 141, from Realejo; Hemsl., Biol. Cent. Am., vol. III, p. 636, without exact locality.

A, *salicifolium* L.

Fourn., Sertum Nic., p. 257; Hemsl., Biol. Cent. Am., vol. III, p. 638; both from Chontales.

A. *skinneri* (Moore) Bak.

Fourn., Sertum Nic., p. 256, as *Athyrium;* Hemsl., Biol. Cent. Am., vol. III, p. 639; both from Granada.

Family VII. CYATHEÆ.

Genus CYATHEA *Smith.*

1. C. ARBOREA (*L.*) *Smith.*

Swz., Syn. Fil., p. 139; Hook., Sp. Fil., vol. I, p. 17; Eaton, Fil. Wr. et Fend., p. 215; Hook. and Bak., Syn. Fil., p. 16; Smith, Ferns. Br. and For., p. 241; Hemsl., Biol. Cent. Am., vol. III, p. 591; Bak., Biol. Cent. Am., vol. IV, p. 115.

Polypodium arboreum L., Syst. Nat., vol. II, p. 694.

C. grevilleana Mart.,—Hook., Sp. Fil., vol. I, p. 22.

Disphenia aculeata Presl, Tent. Pter., p. 56, pl. I, fig. 13.

C. aculeata Willd.,—Hook , Sp. Fil., vol. I, p. 18; Smith, Hist. Fil., p. 245; Smith, Ferns, Br. and For., p 242.

A fine group of plants was observed on the banks of the Los Sabalos River. The one from which herbarium specimens were selected had a trunk about 12 feet high and 3½ inches in diameter. The fronds averaged 10 feet in length. The trunk and stipes were covered with polished, black, straight spines,—some of those on the trunk measuring over ¼ of an inch in length. The sori are chiefly confined to the basal fourth of each segment. The involucres do not show the characteristic even margin of *arborea*, the specimens being quite young. The involucres were at first entirely closed over the sori, and in drying burst rather irregularly. There seems to be no doubt that *C. aculeata* should be included in *arborea*.[1] The bifid receptacle of Presl's *Disphenia* is probably abnormal,[2] and in all other respects *A. aculeata* agrees with aculeate forms of *C. arborea*, and particularly so with the Nicaraguan specimens.

The species has not heretofore been reported from Nicaragua, though Baker gives it in his list from adjacent Costa Rica.

Genus HEMITELIA *Brown.*

1. H. GRANDIFOLIA (*Willd.*) *Spreng.* Pl. XVII, Fig. 1.

Hook., Sp. Fil., vol. 1, p. 30, pl. XIV B; Hook. and Bak., Syn. Fil., p. 28; Smith, Ferns, Br. and For., p. 245.

Common in rich soil along the Deseado River near Camp Menocal. The fronds reach a height of 8 feet. The stipes are 3 feet, or more, in length, and, in the fresh plant, are green or brownish, with sparse short prickles and minute scurfy scales. The stipe and rachis dry to a light brown color. New to Nicaragua. Not reported in the *Biologia Cent. Am.*

2. H. NIGRICANS *Presl.* Pl. XVII, Figs. 2, 3.

Hook. and Bak., Syn. Fil., p. 454; Fourn., Sertum Nic., p. 261; Hemsl., Biol. Cent. Am., vol. III, p. 593.

Not rare in woods near Camp Menocal.

The trunks varied from 3 to 4 feet in height, and 2 to 3 inches in diameter, and were more or less spiny. The fronds were from 4 to 5 feet long, with blackish-brown, scaly stipes.

---

[1] See note under *C. schanschin* in Hook., Sp. Fil., vol. 1, p. 21, and also remarks on *C. arborea* in Smith, Hist. Fil., p. 245.

[2] See also note under *C. arborea* in Hook., Sp. Fil., vol. 1, p. 17.

Reported from Chontales by Fournier (doubtfully), and by Hemsley.

Genus ALSOPHILA *Brown.*

1. A. PHEGOPTEROIDES *Hook.* Pl. XVII, Figs. 4, 5.

Hook. and Bak., Syn. Fil., p. 32.

Rather common in the deep woods near Camp Menocal.

The fronds are tufted, and 2 to 4 feet long.

Hooker and Baker (*ibid.*) describe the Nicaraguan specimens exactly. The species is well-defined and is not easily confounded with any other.

The species is new to Nicaragua and to the entire Central American region. It is not reported in the *Biologia Cent. Am.*

2. A. INFESTA *Kze.* Pl. XVII, Fig. 6.

Presl, Tent. Pter., p. 61; Hook., Sp. Fil., vol. 1, p. 42; Eaton, Fil. Wr. et Fend., p. 214; Hook. and Bak., Syn. Fil., p. 34; Hemsl., Biol. Cent. Am., vol. III, p. 594.

Only sterile specimens were found growing in tufts in the higher deep woods near Castillo. Some were somewhat arborescent. The upper surface of the frond is very dark-green. The stipes are short-hairy, and when fresh were dark-brown.

Hemsley lists it from Guatemala, the only other locality in Central America from which it has been reported.

3. A. ARMATA (*Swartz*) *Presl.*

Presl, Tent. Pter., p. 62; Hook., Sp. Fil., vol. 1, p. 40; Mett., Fil. Hort. Bot. Lip., p. 109; Eaton, Fil. Wr. et Fend., p. 214; Hook. and Bak., Syn. Fil., p. 35; Smith, Hist. Fil., p. 249; Smith, Ferns, Br. and For., p. 245; Hemsl., Biol. Cent. Am., vol. III, p. 593.

A. myosuroides Lieb., Mex. Breg., p. 134.

Cyathea bicrenata Lieb., Mex. Breg., p. 137.

A. hirsuta Kaulf.,—Hook., Sp. Fil., vol. 1, p. 45.

A. mexicana Mart.,—Hook., Sp. Fil., vol. 1, p. 47; Hook. and Bak., Syn. Fil., p. 38.

This fine fern was rather common in the low woods above Camp Menocal. All of the specimens were arborescent, the trunk reaching a height of 10 feet, and a diameter of 3½ inches. Its surface is free from spines, but is covered with closely-appressed, lanceolate, acuminate, glossy scales, which are dark-brown with a narrow lighter border. The leaf-scars are rather smooth, and measure from 5 to 5½ inches in length and 1 to 1¼ inches in width. The fronds were 6 to 8 feet long.

Reported from Chontales by Hemsley.

REPORTED SPECIES.

A. microphylla Klotzsch.

Fourn., Sertum Nic., p. 261, without locality; Hemsl., Biol. Cent. Am., vol. III, p. 594, from Chontales.

A. pruinata (Swartz) Kaulf.

Hemsl., Biol. Cent. Am., vol. III, p. 594, from Chontales.

Lophosoria pruinata Presl,—Fourn., Sertum Nic., p. 260, from Chontales.

Family VIII. WOODSIEÆ.[1]

Genus HYPODERRIS *Brown.*

1. H. SEEMANNI *Prentice.* Pl. XVIII, Figs. 1–3.

Hook. and Bak., Syn. Fil., p. 460; Smith, Hist. Fil., p. 198 (note); Hemsl., Biol. Cent. Am., vol. III, p. 595.

H. adnata Fourn. (?), Sertum Nic., p. 260.

H. marginalis Fourn. (?), Sertum Nic., p. 260.

Found sparingly on the banks of a creek in deep woods near Castillo. Some of the fronds are typical as described by Baker (*ibid.*), while others have the terminal 6 to 12 inches of the frond entire. Some of the fronds reach a total height of 3 feet. Reported from Nicaragua without locality by Baker, from Chontales by Hemsley, and also as *adnata* and *marginalis* (if Baker's and Hemsley's reference of these forms to our species is correct) by Fournier.

---

[1] It was at first the author's intention to leave the Genus *Hypoderris* in the Family *Aspidieæ*, and for that reason the Family *Woodsieæ* is omitted

Family IX. **ASPIDIEÆ.**

Genus DIDYMOCHLÆNA *Desv.*

Reported Species.

D. lunulata Desv.

Fourn., Sertum Nic., p. 259, from Chontales (as *D. sinuosa* Desv.); Hemsl., Biol. Cent. Am., vol. III, p. 641, from Chontales.

Genus OLEANDRA *Cav.*

1. O. NODOSA *Presl.*

Presl, Tent. Pter., p. 78; Eaton, Fil. Wr. et Fend., p. 212; Hook., Sp. Fil., vol. IV, p. 157; Roth., Les Foug., vol. II, p. 69, pl. XXIV; Hook. and Bak., Syn. Fil., p. 303; Smith, Ferns, Br. and For., p. 74; Hemsl., Biol., Cent. Am., vol. III, p. 653; Bak., Biol. Cent. Am., vol. IV, p. 116 (from Costa Rica).

Quite rare, on trunks of trees near Camp Menocal. The specimens are typical.

Not heretofore specifically reported from Nicaragua.

from the outlines in the first part of this paper. But upon more mature reflection it is thought best to separate all the forms with inferior indusia from the Family *Aspidieæ*. The Family *Woodsieæ* should include the genera *Sphæropteris*, *Hypoderris*, *Woodsia* and *Onoclea*, and possibly *Cystopteris*, though its affinities are rather with the *Davallieæ*. Though Eaton's name is adopted, the Family as here recognized is more comprehensive. It may be characterized as follows:

Sori globose, on the back or apex of a vein, indusium membranaceous, inferior, at first usually enclosing the sorus, finally bursting above and forming a cup usually of several radiating divisions.

The Family *Woodsieæ* should be included in the outlines on pp. 124 and 126 of this paper, as No. VIII, between the Family *Cyatheæ* and the Family *Aspidieæ*, and the numbering of the families following it should be correspondingly changed.

So far as the present species is concerned it is by no means certain that it has a place in the genus *Hypoderris*. None of the specimens in the collection show the indusium as perfectly as might be desired, but so far as could be determined from the material in hand the scales or lobes of the indusium do not form a complete cup, but in reality the indusium seems to consist at first of a transverse scale, opening toward the margin of the frond, and ultimately (or at least frequently) dividing into several lobes (see figures). This being the case, if the figure and description of the indusium of *H. brownii*, the type of the genus *Hypoderris*, in *Synopsis Filicum* are correct, it will be necessary to make other disposition of *H. seemanni* by placing it near *Cystopteris*, probably in a new genus.

Genus NEPHROLEPIS *Schott.*

1. N. CORDIFOLIA (*L.*) *Presl.*

Hook. and Bak., Syn. Fil., p. 300; Hemsl., Biol. Cent. Am., vol. III, p. 652; Bak., Jour. Bot., vol. XXII, p. 363 (from Costa Rica); Hitch., Pl. Bah., p. 155.

Polypodium cordifolium L., Syst. Nat., vol. II, p. 692.

Aspidium cordifolium Swartz, Syn. Fil., p. 46.

Nephrolepis tuberosa Presl,—Eaton, Fil. Wr. et Fend., p. 212; Hook., Sp. Fil., vol. IV, p. 151; Smith, Ferns, Br. and For., p. 164.

Nephrolepis pendula Fèe,—Fourn., Sertum Nic., p. 260.

Abundant on a prostrate tree-trunk near the La Juana River, but not found at any other point.

The specimens are quite typical, but rather small, the fronds averaging less than a foot in length, and about an inch in width. The pinnæ are deciduous. Reported from Chontales by Fournier as *N. pendula* Fée.

2. N. ACUTA (*Schk.*) *Presl.*

Lieb., Mex. Breg., p. 117; Hook., Sp. Fil., vol. IV, p. 153; Bed., Ferns S. Ind., p. 33, pl. XCIV; Hook. and Bak., Syn. Fil., p. 301; Hemsl., Biol. Cent. Am., vol. III, p. 652; Hitch., Pl. Bah., p. 155.

Aspidium acutum Schk.,—Swz., Syn. Fil., p. 46.

Nephrodium acutum Presl, Rel. Haenk., p. 31.

Nephrolepis acuminata Presl,—Lieb., Mex. Breg., p. 119.

Nephrolepis punctulata Presl,—Eaton, Fil. Wr. et Fend., p. 212; (var.) Fourn., Sertum Nic., p. 260.

This handsome (when growing) species was common in the low woods near Castillo, the short rootstocks crowding among the bases of the petioles of palm leaves, and the fronds forming a gracefully drooping fringe just below the crown of leaves at the summit of the host palm-stem. A smaller form, more rigid in habit, and with pinnæ more nearly entire, was found on a prostrate log near the La Juana River.

The Castillo specimens have the pinnæ distinctly crenate, and sometimes auricled on both the upper and lower sides, in which case the auricles are smaller and more rounded. Many of the fronds exceeded three feet in length.

All of the specimens from both localities are ferrugineo-tomentose on the stipe, rachis, the lower surface of the pinnæ, and on the midribs of the pinnæ on the upper surface, thus being the *var. subferruginea* of Hooker[1], or what Baker[2] says "appears to be *N. rufescens* Presl."

The species was also observed near Camp Menocal. Hemsley reports it from Chontales. Fournier gives it in his Nicaraguan list, without locality, under the name *N. punctulata* Presl, var.

Genus NEPHRODIUM[3] *Rich.*

1. N. CONTERMINUM (*Willd.*) *Desv.* Pl. XVIII, Fig. 4.

Hook., Sp. Fil., vol. IV, p. 91; Hook. and Bak., Syn. Fil., p. 268; Hemsl., Biol. Cent. Am., vol. III, p. 645; Bak., Jour. Bot., vol. XXII, p. 363; Hitch., Pl. Bah., p. 154.

N. panamense Presl, Rel. Haenk., p. 35.

Aspidium conterminum Willd.,—Mett., Üb. Ein. Farng., pt. IV, p. 78; Eaton, Fil. Wr. et Fend., p. 209; Eaton, Ferns N. Am., vol. II, pp. XXIV, and 278.

Lastrea contermina Willd.,—Smith, Hist. Fil., p. 214; Smith, Ferns, Br. and For., p. 154.

Aspidium molliculum Kze.,—Fourn., Sertum Nic., p. 254.

Aspidium conterminum var. *strigosum* D. C. E.,—Underwood, Our Nat. Ferns and All., p. 104; Chapm., Fl. So. St., p. 671.

Terrestrial, and rather gregarious in habit. Very common along the La Juana River on higher bottom lands, and also found in similar situations along the San Juan River near Castillo, and at Boca del Rama. It was also observed at Greytown and near Camp Menocal. A few specimens were collected in a gulley at the base of the volcano Ometépe, where the species was quite rare.

Much variation in the character of the surface is exhibited by the large series in the collection. The most common form, found along the La Juana River, is copiously clothed with white hairs on the stipe, rachis, both surfaces of the pinnæ, and the indusium, and is almost wholly destitute of resinous glands. This form was also collected near Castillo. Another form, less common in the former locality, has comparatively few hairs, but resin-dots are very abundant on the lower surface of the frond. Similar specimens were found near Castillo, and those from Ometépe differ only in having the stipe and rachis almost entirely smooth. This form, especially the La Juana specimens, answers well to Eaton's *var. strigosum.*

---

[1] Sp. Fil., vol. IV, p. 153.

[2] In Hook. and Bak., Syn. Fil., p. 301, note under *N. acuta* Presl.

[3] This genus is usually united with *Aspidium* by American authors. While it is true that specimens are often found which cannot be definitely referred to either genus, this difficulty is no greater than that which is often encountered between *Aspidium* (in the widest sense) and *Phegopteris*, and is usually readily overcome if the specimens are fresh, or were collected in good condition. *Nephrodium* certainly has as good claim to existence as have *Nephrolepis* and *Fadyenia*. The large number of species makes the division convenient to say the least.

The specimen from Boca del Rama is wholly destitute of hairs, but resin-dots are exceedingly abundant on the lower surface of the frond, and on the rachis. The indusium in all the forms is fugacious. Baker[1] says of this species: "Fée makes of this a genus *Oochlamys*, characterized by an involucre receding from that of typical *Nephrodium* toward *Aspidium*."

In younger specimens the indusium is distinctly rounded cordate and clearly that of *Nephrodium*. It is only when the indusium is loosened and about to drop away that this character becomes indistinct.

Fournier reports this species from near Nandaimé under the name *Aspidium molliculum* Kze.

2. N. MEXICANUM[2] *Presl.* Pl. XVIII, Fig. 5.

Presl, Rel. Haenk., p. 38; Mett., Üb. Ein. Farng., pt. IV, p. 64; Hook., Sp. Fil., vol. IV, p. 138, pl. CCLXII.

Nephrodium patulum Bak.,—Hook. and Bak., Syn. Fil., p. 276; Hemsl., Biol. Cent. Am., vol. III, p. 649; Bak., Jour. Bot., vol. XXII, p. 363 (from Costa Rica).

Lastrea mexicana Hook. (*non* Lieb.),—Smith, Hist. Fil., p. 215; Smith, Ferns, Br. and For., p. 157.

Aspidium mexicanum Presl,—Eaton, Fil. Wr. et Fend., p. 209.

Aspidium mexicanum var. *serratum* Mett.,—Fourn., Sertum Nic., p. 255.

A single, sterile specimen was found near the La Juana River. A comparison with specimens in the Shaw Herbarium, and with the descriptions cited, leaves no doubt of the correctness of the determination.

---

[1] In Hook. and Bak., Syn. Fil., p. 268, note under *N. conterminum.*

[2] The author could find no good reason for substituting *N. patulum* for Presl's older name, as has been done by Baker and others.

Reported from Realejo by Hooker (*ibid.*), from Ometépe by Fournier (as *var. serratum*), and from Chontales and Ometépe by Hemsley (as *patulum*).

3. N. SPHÆROCARPUM (*Fée*) *Hook.* Pl. XVIII, Fig 6.

Hook., Sp. Fil., vol. IV, p. 139; Hook. and Bak., Syn. Fil., p. 277; Hemsl., Biol. Cent. Am., vol. III, p. 650.

Lastrea athyrioides Lieb., Mex. Breg., p. 122.

Weaker and more delicate than *N. mexicanum*, and with a very distinct, membranous, reniform indusium. Otherwise like that species, with which it may have to be united.

Found sparingly in the deep woods near Moyogalpa, on Ometépe.

Not heretofore reported from Nicaragua. It is possible, however, that Fournier's *A. mexicanum* var. *serratum*[1] is this form.

4. N. KARWINSKYANUM (*Mett.*) *Bak.* Pl. XVIII, Figs. 7, 8.

Hook and Bak., Syn. Fil., p. 279; Hemsl., Biol. Cent. Am., vol. III, p. 647.

Lastrea mexicana Lieb. (*non.* Presl), Mex. Breg., p. 120.

Aspidium karwinskyanum Mett., Üb. Ein. Farng., pt. IV, p. 59; Fourn., Sertum Nic., p. 255.

Nephrodium sphærocarpum var. *glandulosum* Hook., Sp. Fil., vol. IV, p. 139.

A form which was quite common in the rich soil of the lower deep woods near Castillo is referred to this species with some doubt. Baker's description in *Synopsis Filicum* agrees with the specimens in the collection in dimensions, division, form of the frond, surface, and character of the indusium, but the lobes are acutely instead of "bluntly-lobed." J. Donnell Smith's specimen from Guatemala in the Shaw Herbarium is like the Castillo specimens except that it has somewhat blunter lobes, and the indusium is more hairy over the entire surface, that of the latter form being but sparsely hairy on the surface and margin, but with an abundance of resin-dots.

But for the much smaller dimensions of the fronds, which

---

[1] See under preceding species.

are in full fruit, together with the less compound division and less coriaceous texture of the frond, and of the presence of a prominent persistent indusium, the author would refer these specimens to the following species with which they agree in hairiness of the stipe and rachises, in venation and the position of the sori, in the decurrent pinnules and segments forming wings on the secondary rachises, and in the form, division and margin of the ultimate divisions of the frond, which are almost identical.

The fronds measure from 15 to 30 inches in total length (including stipe), and are thrice-pinnatifid. When growing the stipe was green, hairy, and brown-scaly at base.

Fournier and Hemsley report it from Ometépe.

5. N. EFFUSUM (*Swartz*) *Bak.* Pl. XVIII, Fig. 9.

Hook. and Bak., Syn. Fil., p. 287; Hemsl., Biol. Cent. Am., vol. III, p. 646; Bak., Jour. Bot., vol. XXII, p. 363 (from Costa Rica); Hitch., Pl. Bah., p. 155.

Polypodium effusum Swartz, Fl. Ind. Occ., p. 1690; Swz., Syn. Fil., p. 41; Roth., Les Foug., vol. I, p. 127, pl. VII.

Polypodium divergens Swartz, Syn. Fil., p. 73.

Polypodium dilatum Lieb., Mex. Breg., p. 56; Hook., Sp. Fil., vol. IV, p. 264.

Phegopteris divergens Fée,— Mett., Üb. Ein. Farng., pt. IV, p. 14; Smith, Hist. Fil., p. 233; Smith, Ferns, Br. and For., p. 170.

Aspidium excultum Mett., Üb. Ein. Farng., pt. IV, p. 69.

Nephrodium excultum Hook., Sp. Fil., vol. IV, p. 149.

Phegopteris effusa Swartz,—Smith, Hist. Fil., p. 233; Smith, Ferns, Br. and For., p. 170.

Typical specimens of this fine species were collected along the La Juana River. The fronds reached a total length of 4 feet, and were mostly quadripinnate at the base, broadly triangular, with the lowest pair of pinnæ 18 to 20 inches long. The sori are small, and in the living plants only occasionally showed imperfectly developed indusia, which are entirely wanting in the dried specimens. The stipes are coarse, brownish-green when fresh, and rough with obscure spines. The lower surface of the frond, including the rachis is densely covered with resin-dots.

Not heretofore specifically reported from Nicaragua.

6. N. SKINNERI *Hook.*

Hook., Sp. Fil., vol. IV, p. 64; Hook. and Bak., Syn. Fil., p. 287; Hemsl., Biol. Cent. Am., vol. III, p. 650.

Aspidium skinneri Hook., Cent. Ferns, pl. XXIV; Mett., Üb. Ein. Farng., pt. IV, p. 92.

Aspidium francoanum Fourn., Sertum Nic., p. 255.

Nephrodium stenophyllum Bak., Jour. Bot., vol. XXII, p. 363.

Nephrodium harrisoni Bak., Sum. New Ferns, p. 66.

Found in mud among rocks near the water's edge along the Los Sabalos River. Quite rare. Nine plants with seventeen fronds were collected after careful search.

The specimens are small, the largest frond measuring as follows: stipe 1¼ in.; frond 4 in. in length and a trifle over ½ an inch in width. Only three fronds show a disposition toward the separation of the lowest pair of lobes from the lamina. In the remaining fronds the lobes diminish quite regularly from the center toward both the base and apex of the frond, disappearing toward the apex entirely. The stipes are both hairy and sparsely scaly, and the midribs on both surfaces, and the main veins on the lower surface, are hairy.

Several fronds show the prominently ciliated, deciduous indusium.

The details figured in Hooker's excellent plate accurately represent the Nicaraguan material, but occasionally the two lowest veins of adjacent groups unite before reaching the sinus.

Baker's description of *N. stenophyllum* (= *harrisoni*) shows no important distinction between his species and *skinneri*, and a specimen of *N. harrisoni* from Costa Rica (J. Donnell Smith's no. 5097) in the Shaw Herbarium is undoubtedly the same as the Los Sabalos specimens, though the latter are much smaller.

Reported from Chontales by Hemsley, and by Fournier (as *A. francoanum*).

7. N. PARASITICUM (*L.*) *Shimek.* Pl. XVIII, Fig. 10.

Polypodium parasiticum L., Syst. Nat., vol. II, p. 693.

Aspidium molle Jacq.,—Swz., Syn. Fil., p. 49; Mett., Fil. Hort. Bot. Lip., p. 91; Eaton, Fil. Wr. et Fend., p. 211; Roth., Les Foug., vol. II, p. 126.

Aspidium parasiticum Swz, Syn. Fil., p. 49.

Nephrodium molle Desv.,—Lieb., Mex. Breg., p. 123; Mett., Üb. Ein Farng., pt. IV, p. 103; Hook., Sp. Fil., vol. IV, p. 67 (in part); Hook. and Bak., Syn. Fil., p. 293; Smith, Ferns, Br. and For., p. 140; Hemsl., Biol. Cent. Am., vol. III, p. 648; Hitch., Pl. Bah., p. 155.

Rare in deep woods near Castillo. Two specimens, one fertile and one sterile, were found. The rootstocks were nearly erect, and are covered by the coarse, rigid, dark-colored roots, and the bases of old stipes. The stipe, rachis and midribs of the pinnæ are densely coated with short purplish-brown hairs, the form probably being *A. violascens* Link. The veins and margins of the pinnæ are white-hairy, and the indusia, which are small and distinct, but deciduous, are ciliated with long white hairs.

The fertile frond is narrower, with more remote pinnæ. There seems to be no question that this is *P. parasiticum* L., and the latter specific name was used by the earlier authors. Reported from Realejo by Hemsley.

8. N. ENDRESI *Bak.* Pl. XVIII, Figs. 11, 12.

Bak., Sum. New Ferns, p. 69 (from Costa Rica).

The specimens in the collection agree exactly with Baker's description excepting that the stipes in all are sparsely scaly near the base. The scales are lanceolate, acute and brown. Four plants with nine fronds were collected in the somewhat sandy soil of the higher woods near Castillo. Of these three are copiously fruited, and the others show a few scattered sori. The fertile fronds are not uniformly smaller than the sterile. All are cordate at the base, and one shows indications of lobes near the base. The sori, which are provided with distinct, smooth, reniform indusia, are sometimes placed at the ends of free included veinlets, but more frequently they are attached at or near the juncture of two or three veins.

The stipes measure from 3¼ to 12 inches, and the fronds from 4 to 6½ inches in length. In width the latter vary from 1¼ to 2½ inches.

The rootstock is short, $\frac{3}{16}$ of an inch in diameter, horizontal, brown, and is covered with the dark-brown wiry roots, and the bases of old stipes. New to the Nicaraguan list, having been heretofore reported only from the original locality in Costa Rica.

9. N. CICUTARIUM (*L.*) *Bak.*

Hook. and Bak., Syn. Fil., p. 299; Hemsl., Biol. Cent. Am., vol. III, p. 645; Hitch., Pl. Bah., p. 155.

Polypodium cicutarium L., Syst. Nat., vol. II, p. 693.

Polypodium appendiculatum Swz., Fl. Ind. Occ., p. 1677.

Aspidium hippocrepis Swz., Syn. Fil., p. 51.

Aspidium coriandrifolium Swz., Syn. Fil., p. 51.

Aspidium cicutarium Swz., Syn. Fil., p. 51; Mett., Üb. Ein. Farng., pt. IV, p. 117; Eaton, Fil., Wr. et Fend., p. 211; Hook., Sp. Fil., vol. IV, p. 48; Smith, Hist. Fil., p. 202; Smith, Ferns, Br. and For., p. 145.

Aspidium coadunatum Wall.,—Hook. et Grev., Icon. Fil., pl. CCII; Mett; Fil. Hort. Bot. Lip., p. 94, pl. XXII, figs. 3, 4; Smith, Hist. Fil., p. 203.

Aspidium latifolium Presl, Rel. Haenk., p. 30; Hook., Sp. Fil., vol. IV, p. 151.

Nephrodium hippocrepis Presl, Rel. Haenk., p. 36.

Sagenia cicutaria Presl, Tent. Pter., p. 87, pl. II, figs. 24, 25.

Sagenia coadunata Moore,—Bed., Ferns S. Ind., p. 24, pl. LXXXI.

This well-known and widely distributed species was collected at all the stations, and the large series of specimens shows much variation in size, texture, surface and division. A coriaceous form, with stipe and rachises dark-brown and nearly smooth, with one pair of lateral pinnæ which are deeply lobed or compound, the fronds measuring 12 to 14 inches, and the stipes 14 to 16 inches in length, and with the lobes of the pinnæ elongated and acuminate, was collected along the La Juana River, and near Camp Menocal. Specimens from the banks of the San Juan River near Castillo have the two lowest pairs of pinnæ compound, the lobes of the pinnules deeply crenately lobed, and the rachises short-hairy. The fronds measure 15 to 20 inches, and the stipes 16 to 18 inches in length. The fronds are firm but scarcely coriaceous. A specimen from Boca del Rama has the terminal division of the frond small, but there are 8 pairs of narrow pinnæ which are not lobed, but merely very coarsely crenate. The frond is 19 inches long and but 10 inches wide, and is coriaceous in texture. A form which was common along the Los Sabalos River has 3 to 5 pairs of lateral pinnæ, the lowest pair compound, the lobes of the pinnæ, etc., narrow, acuminate, and somewhat crenate. The fronds measure 11 to 21 inches in length, and 9 to 15 inches in width, and are thinly herbaceous in texture. The rachises are short-hairy, and the stipes are scaly at the base. Specimens from Ometépe and the deep woods near Castillo are thin, almost membranaceous in texture, and have the stipes and rachises lighter-colored. The former are very small, the stipes measuring 3 to 5 inches in length, and the fronds 4½ to 6½ inches in length, and 3 to 5 inches in width. The pinnæ are deeply crenate or lobed, but none are compound. The stipes and rachises are short-hairy. The latter have 1 to 3 pairs of lateral pinnæ, the lowest sometimes compound at base, and the stipes, rachises, main veins and margin of the frond are copiously covered with spreading, whitish or brownish hairs. The fronds are 6 to 12 inches long, and 5 to 12 inch wide, and the stipes are 8 to 19 inches inches in length. All of the specimens agree in having a smooth, reniform (or rather cordate at the sinus) indusium, in venation and the position of the sori, and in having a long basal lobe on the lower side of the lowest pair of pinnæ. The species is terrestrial in habit.

Reported from Chontales by Hemsley.

10. N. MACROPHYLLUM (*Swartz*) *Bak.*

Hook. and Bak., Syn. Fil., p. 300; Hemsl., Biol. Cent. Am., vol. III, p. 648; Hitch., Pl. Bah., p. 155.

Aspidium macrophyllum Swz., Syn. Fil., pp. 43, 239; Presl, Rel. Haenk., p. 29; Mett., Fil. Hort. Bot. Lip., p. 95, pl. XXII, fig. 13; Mett., Üb. Ein. Farng., pt. IV, p. 122; Eaton, Fil. Wr. et Fend., p. 211; Hook., Sp. Fil., vol. IV, p. 55; Smith, Hist. Fil., p. 202; Smith, Ferns, Br. and For., p. 145.

Bathmium pœppigii Presl, (?)—Fourn., Sertum Nic., p. 256 (on authority of Hemsley).

Typical specimens of this species were common along the somewhat rocky banks of the San Juan River, below Castillo.

Reported from Chontales by Fournier (as *Bathmium pœppigii*), and by Hemsley.

Reported Species.

N. chontalense (Fourn.) Hemsl.

Fourn., Sertum Nic., p. 254 (as *Aspidinm*); Hemsl., Biol. Cent. Am., vol. III, p. 645; Bak., Sum. New Ferns, p. 62; all from Chontales.

N. falciculatum Desv.

Hemsl., Biol. Cent. Am., vol. III, p. 646, without exact locality.

N. levyi (Fourn.) Bak.

Fourn., Sertum Nic., p. 255 (as *Aspidium*) from Chontales; Hook. and Bak., Syn. Fil., p. 502, without exact locality; Hemsl., Biol. Cent. Am., vol. III, p. 647, from Chontales.

N. patens (Swartz.) Desv.

Hemsl., Biol. Cent. Am., vol. III, p. 648, without exact locality.

N. sprengeli (Kaulf.) Hook.

Fourn., Sertum Nic., p. 254 (as *Aspidium*); Hemsl., Biol. Cent. Am., vol. III, p. 650; both from Chontales.

N. triste (Kze.) Hook.

Hemsl., Biol. Cent. Am., vol. III, p. 651, from Chontales.

N. villosum (Swartz.) Presl.

Hemsl., Biol. Cent. Am., vol. III, p. 651, from Chontales.

Genus ASPIDIUM (*Swartz*) *R. Br.*

1. A. SEMICORDATUM *Swartz* (*Swartz*).

Swz., Syn. Fil., p. 45; Mett. Üb. Ein. Farng., pt. IV, p. 36; Eaton, Fil. Wr. et Fend., p. 208; Hook., Sp. Fil., vol. IV, p. 16; Hook. and Bak., Syn. Fil., p. 249; Fourn., Sertum Nic., p. 255; Hemsl., Biol. Cent. Am., vol. III, p. 643.

Polypodium semicordatum Swz., Fl. Ind. Occ., p. 1651.

Nephrodium semicordatum Presl, Rel. Haenk., p. 32.

Lastrea semicordata Presl, Tent. Pter., p. 77, pl. II, fig. 8; Lieb., Mex. Breg., p. 122.

Cyclopeltis semicordata Smith, Hist. Fil., p. 225; Smith, Ferns, Br. and For., p. 165.

Quite common on the banks of a small stream near Castillo, and along the La Juana River. A few specimens were also found growing on trunks of living trees near Castillo.

The specimens are nearly typical, but have the entire stipe and a part of the rachis fibrillose with long narrow, acuminate, light-brown scales. Most of the pinnæ are cordate on the lower, and truncate on the upper side at the base. Forms which are truncate, cordate or rounded on both sides also occur. Most of the pinnæ are distinctly crenato-repand, but some are nearly entire.

Reported from Granada and Chontales by Fournier (as *Aspidium*), and by Hemsley.

2. A. TRIFOLIATUM (*L.*) *Swartz.*

Swz., Syn. Fil., p. 43; Presl, Tent. Pter., p. 88, pl. II, fig. 27; Lieb., Mex. Breg., p. 125; Mett., Fil. Hort. Bot. Lip., p. 95, pl. XXII, figs. 10, 11, 12; Mett., Üb. Ein. Farng., pt. IV, p. 126; Eaton, Fil. Wr. et Fend., p. 211; Hook., Sp. Fil., vol. IV, p. 45; Roth., Les Foug., vol. I, p. 177, pl. XXX; Hook. and Bak., Syn. Fil., p. 258; Smith, Ferns, Br. and For., p. 145; Underwood, Our Nat. Ferns and All., p. 102; Chapm., Fl. So. St., p. 671; Hemsl., Biol. Cent. Am., vol. III, p. 643; Bak., Biol. Cent. Am., vol. IV, p. 116; Bak., Jour. Bot., vol. XXII, p. 363 (the two latter from Costa Rica).

Polypodium trifoliatum L., Syst. Nat., vol. II, p. 692.

Bathmium trifoliatum Link. (and var. *heracleifolium* Fée).—Fourn., Sertum Nic., p. 256.

Quite rare near Castillo. One specimen, collected in deep woods, has the lower lobes free, the frond being compound, and all the lobes are again deeply lobed. The remaining specimens, which were collected on the banks of the San Juan River below Castillo, have simple fronds which are deeply three-lobed. The lobes are almost entire, the basal pair being only slightly lobed below. The fronds are small, measuring as follows: stipe 3½ to 4½ inches; frond 4½ to 5½ inches long, and 3½ to 4½ inches wide. Habit, terrestrial.

Reported from Chontales by Fournier (as *Bathmium*, with var.), and by Hemsley.

REPORTED SPECIES.

A. meniscioides Willd.

Fourn., Sertum Nic., p. 256, (as *Cyclodium*); Hemsl., Biol. Cent. Am., vol. III, p. 643; both from Chontales.

A. nicaraguense (Fourn.) Bak.

Fourn., Sertum Nic., p, 256 (as *Bathmium*); Hook. and Bak., Syn. Fil., p. 493; Hemsl., Biol. Cent. Am., vol. III, p. 643; all from Chontales.

Genus PHEGOPTERIS *Fée.*

1. P. DECUSSATA (*L.*) *Mett.*

Mett., Fil. Hort. Bot. Lip., p. 83, pl. XVII; Smith, Ferns, Br. and For., p. 169.

Polypodium decussatum L., Syst. Nat., p. 694; Swz., Syn. Fil., p. 40; Hook., Sp. Fil., vol. IV, p. 243; Hook. and Bak., Syn. Fil., p. 307; Hemsl., Biol. Cent. Am., vol. III, p. 656.

Rather rare in deep woods near Camp Menocal. Stipes 2 to 3 feet, fronds 3 to 4 feet long. The stipes and rachises are brown, densely coated with short whitish hairs. The veins beneath are white-hairy, and the margins of the frond are densely short-ciliated. The characteristic gland at the base of each pinna, and the two opposite lines of scales on the stipe, were present in all the specimens observed. A fine fern.

Reported from Chontales by Hemsley.

2. P. PUNCTATA (*Thunb.*) *Mett.* Pl. XIX, Figs. 1, 2.

Mett., Üb. Ein. Farng., pt. IV, p. 12.

Polypodium punctatum Thunb. (*non* Spruce),—Swz., Syn. Fil., p. 41; Hook. and Bak., Syn., Fil., p. 312.

Polypodium rugulosum Labill.,—Hook., Sp. Fil., vol. IV, p. 272.

Phegopteris rugulosa Fée,—Smith, Ferns, Br. and For., p. 171.

A careful comparison with the cited descriptions, and with specimens in the State University Herbarium and that of the Shaw Gardens at St. Louis, renders this identification quite satisfactory, though the species, which is widely spread, is not mentioned in the *Biologia Cent. Am.*, nor is it reported from Central America in any work at hand, Colombia, S. Am., being the nearest locality. The specimens in the collection agree well with Hooker's description of *P. rugulosum.* The resemblance to forms of *Hypolepis*, which is striking, is discussed in the note under *P. rugulosum* hy Hooker.[1] The fruit however is distinct. The stipe shows but few tubercles (where scales were attached), but its base is densely covered with a tangle of long, very narrow (almost hair-like), light-brown scales, most of which exceed an inch in length. Shorter scales are also scattered along the rachises and main veins,

---

[1] Sp. Fil., vol. IV, p. 273.

which are also densely covered with prostrate resin-rods. The margins of the frond are ciliated. The sori appear to be nearly marginal because the edges of the segments are more or less reflexed.

The fronds (including the stipe) reach a total length of 4 feet.

Rather rare in low grounds in deep woods near Castillo.

3. P. CRENATA (*Swartz*) *Mett.*

Polypodium crenatum, Swartz, Fl. Ind. Occ., p. 166; Swz., Syn. Fil., p. 37; Hook., Fil. Ex., pl. LXXXIV; Hook., Sp. Fil., vol. V, p. 2; Roth., Les Foug., vol. II, p. 18, pl III; Hook. and Bak., Syn. Fil., p. 315; Hemsl., Biol. Cent. Am., vol. III, p. 656; Hitch., Pl. Bah., p. 156.

Goniopteris crenata Presl, Tent. Pter., p. 183. pl. VII, fig. 10; Smith, Hist. Fil., p. 192; Smith, Ferns, Br. and For., p. 138.

Typical, rather hairy, specimens were common among weeds on a banana plantation near Castillo. A smoother form, with five pairs of lateral pinnæ, was collected in waste ground at Boca del Rama.

Reported from Chontales by Fournier.

4. P. TETRAGONA (*Swartz*) *Mett.* Pl. XIX, Figs. 3, 4.

Mett., Fil. Hort. Bot. Lip., p. 84; Mett., Üb. Ein. Farng., pt. IV, p. 22; Eaton, Fil. Wr. et Fend., p. 207; Fourn., Sertum Nic., p. 253.

Polypodium tetragonum Swz., Fl. Ind. Occ., p. 1760; Swz., Syn. Fil., p 37; Lieb., Mex. Breg., p. 59; Hook., Sp. Fil., vol. V, p. 3; Hook. and Bak., Syn. Fil., p. 317; Hemsl., Biol. Cent. Am., vol. III, p. 670; Hitch., Pl. Bah., p. 156.

Polypodium megalodus Schk.,—Presl, Rel. Haenk., p. 24.

Phegopteris megalodus, Mett., Üb. Ein. Farng., pt. IV, p. 24; Eaton, Fil. Wr. et Fend., p. 207.

Goniopteris megalodes Presl,—Smith, Hist. Fil., p. 192; Smith, Ferns, Br. and For., p. 138.

Goniopteris tetragona Swz.,—Smith, Hist. Fil., p. 192; Smith, Ferns, Br. and For., p. 138; Fourn., Bull. Soc. Bot. Fr., vol. XVII, p. 236.

Polypodium tetragonum var. *megalodum* (Schk.) Bak., Hitch., Pl. Bah., p. 156.

In his paper "*On the Recent Synonymy of Brazilian Ferns*" Baker substitutes *Polypodium androgynum* Poir. for *P. tetragonum.* In the second edition of "*Synopsis Filicum*," published in the same year, the following statement is reproduced from the first edition without correction:[1] "Judging from the figures quoted, this is *P androgynum* of Poiret; and if so, that name has priority." Having no additional information the author retains *P. tetragona*. If the change becomes necessary the name should be *Phegopteris androgyna* (Poir), and that of the variety *P. androgyna* var. *megaloda* (Schk.).

The type was quite common in low grounds in the deep woods near Castillo. Some of the pinnæ have the veins of contiguous groups free, thus connecting the sub-genera *Euphegopteris* and *Goniopteris*.

The variety, *P. tetragona* var. *megaloda* (Schk.), was also abundant along the La Juana River and near Castillo. The venation of the Castillo form is represented in Fig. 4, that of the La Juana specimen in Fig. 3. The stipe is purplish-green when fresh.

Fournier and Hemsley report the type from Granada. The variety has not been reported from Nicaragua.

5. P. DRACONOPTERUM (*Eaton*) *Shimek*. Pl. XIX, Figs. 5, 6.

Aspidium draconopterum Eaton, Fil. Wr. et Fend., p. 211.

Polypodium draconopterum Hook., Sp. Fil., vol. v, p. 86; Hook. and Bak., Syn. Fil., p. 319.

Smith[2] refers this to *Dryomenis purdiei* Smith, but that name, though older, is proposed in the "*Botany of the Herald*"[3] without a description. Hence Eaton's name, which is accompanied by a full description, is adopted. Smith makes no mention of this species in his "*Ferns, British and Foreign*" which was published a year later than the "*Historia Filicum*."

Typical specimens were quite common along the high banks of a small stream in deep woods near Castillo.

The species has not heretofore been reported from Central America, the nearest locality being New Granada, from which Eaton's type-specimens were received.

[1] Note under *P. tetragonum*, p. 317.

[2] Hist. Fil., p. 193.

[3] Seemann's Botany of the Voyage of H. M. S. Herald, p. 229.

REPORTED SPECIES.

P. martinicensis Fourn.

Fourn., Sertum Nic., p. 252, from Nicaragua without locality. No other reference to this species was found.

P. nicaraguensis Fourn.

Fourn., Sertum Nic., p. 252; Hemsl., Biol. Cent. Am., vol. III, p. 665; both from Chontales.

Family X. ACROSTICHEÆ.

Genus ACROSTICHUM *L.*

1. A. TATEI *Baker*. Pl. XIX, Figs, 7, 8.

Hook. and Bak., Syn. Fil., p. 518; Hemsl., Biol. Cent. Am., vol. III, p. 690.

This fern was rather common in the woods near Camp Menocal, climbing on the trunks of trees by its slender, wiry rootstocks. Only two fertile fronds were found however, as the season was not sufficiently advanced.

The specimens are typical, but only one sterile frond reaches a length of 6 inches, the others being smaller. A rather small specimen is represented in Fig. 7. The fertile fronds are narrower, and each is about 5 inches long. Reported from Chontales by both Baker and Hemsley.

2. A. SCOLOPENDRIFOLIUM *Raddi.* Pl. XIX, Figs. 9, 10.

Hook., Sp. Fil., vol. V, p. 211; Hook. and Bak., Syn. Fil., p. 407; Hemsl., Biol. Cent. Am., vol. III, p. 689.

A. nitidum Lieb., Mex. Breg., p. 16.

Elaphoglossum scolopendrifolium Raddi,—Smith, Hist. Fil., p. 127; Smith, Ferns, Br. and For., p. 106.

Two sterile fronds of what seems to be this species were collected near Camp Menocal. The species was not uncommon on trunks of trees, but no fertile fronds were observed. It is for this reason that some doubt is here expressed, though the sterile fronds are sufficiently characteristic. The fronds are each 13 inches long, and 2¼ inches wide. One stipe is 2 inches long, the other is missing.

It has not been reported from Nicaragua, Panama and Guatemala being the nearest localities.

3. A. SORBIFOLIUM *L.*

Linn., Syst. Nat., vol. II, p. 686; Hook., Sp. Fil., vol. V, p. 241; Hook. and Bak., Syn. Fil., p. 412; Hemsl., Biol. Cent. Am., vol. III, p. 689.

Onoclea sorbifolium Swz, Syn. Fil., p. 112.

Lomariopsis wrightii Mett. in Eaton, Fil. Wr. et Fend., p. 194.

Lomariopsis sorbifolia Fée,—Eaton, Fil. Wr. et Fend., p. 195; Smith, Hist. Fil., p. 140; Smith, Ferns, Br. and For., p. 114.

Lomariopsis longifolia Smith, Ferns, Br. and For., p. 114.

Lomariopsis vestita Fourn., Sertum Nic., p. 250.

Climbing on trunks of trees to a height of 2 to 7 feet. The rootstock retains its connection with the soil, and is crowned with a tuft of fronds, the lower and outer of which are sterile. Similar tufts sometimes appear on short branches of the rootstock at some distance from the tip.

Some of the sterile fronds exceed 2 feet in length, and they are but 3 to 6 inches wide. The pinnæ are mostly sessile, and vary somewhat in the depth of the marginal denticulations, and in the length of the acuminate apex. One of the fertile fronds is sterile in its lower half.

Common in the higher woods near Castillo, where the fertile fronds were just beginning to appear at the time of collecting, and along the Deseado River above Camp Menocal.

Reported from Chontales by Fournier (as *L. vestita*), and by Hemsley.

4 A. OSMUNDACEUM (*H. B. K.*) *Hook.* Pl. XIX, Fig. 11; Pl. XX, Fig. 1.

Hook., Sp. Fil., vol. V, p. 246; Bak., Rec. Syn. Braz. Ferns, p. 26; Hook. and Bak., Syn. Fil., p. 415.

Polybotrya osmundacea H. B. K.,—Presl, Tent. Pter., p. 231, pl. X, figs. 9, 10; Eaton, Fil. Wr. et Fend., p. 196; Roth., Les Foug., vol. II, p. 79, pl. XXVIII; Smith, Hist. Fil., p. 133; Smith, Ferns, Br. and For., p. 112.

Acrostichum cylindricum Hook., Sp. Fil., vol. V, p. 246.

With the habit of growth of *A. sorbifolium.* The rootstock is ⅜ of an inch thick. In the specimen in the collection the scales have all fallen away, leaving irregular tubercles. Only one specimen with both fertile and sterile fronds was found in the woods near Castillo.

The fronds are tri-pinnatifid, and quite typical, resembling very closely Fendler's No. 69 from Trinidad, in the Shaw Herbarium.

New to Nicaragua and Central America. It is not reported in the *Biologia Cent. Am.*

5. A. CANALICULATUM (*Klotzsch*) *Hook.* Pl. XIX, Fig. 12. Pl. XX, Fig. 2.

Hook., Sp. Fil., vol. V, p. 247; Hook. and Bak., Syn. Fil., p. 415.

Polybotrya canaliculata Klotzsch,—Mett., Fil. Hort. Bot. Lip., p. 24; Eaton, Fil. Wr. et Fend., p. 196; Smith, Hist. Fil., p. 133.

The fronds are tri-pinnate. The difference in the cutting of the pinnules between this and the preceding species is shown by the figures. The specimens in the collection closely resemble Fendler's No. 262 from Venezuela, in the Shaw Herbarium. One group of specimens was found near Camp Menocal. The plants were growing in rich soil in a rather open portion of the woods. None were climbing.

This species is also new to Nicaragua and to Central America.

6. A. PELTATUM *Swartz.*

Swz., Fl. Ind. Occ., p. 1593; Swz., Syn. Fil., p. 11; Lieb., Mex. Breg., p. 19; Mett., Fil. Hort. Bot. Lip., p. 18; Eaton, Fil. Wr. et Fend., p. 193; Hook., Sp. Fil., vol. V, p. 252; Hook. and Bak., Syn. Fil., p. 416; Hemsl., Biol. Cent. Am., vol. III, p. 688.

Olfersia peltata Presl, Tent. Pter., p. 234, pl. X, fig. 15.

Acrostichum fœniculaceum H. et G., Icon. Fil., pl. CXIX.

Rhipidopteris peltata Swz.,—Smith, Hist. Fil., p. 130; Smith, Ferns, Br. and For., p. 110; Fourn., Sertum Nic., p. 250.

A few sterile fronds only were collected on rocks subject to overflow, below the lower falls of the Deseado River near the Divide.

Reported (as *Rhipidopteris*) from Nicaragua without locality by Fournier.

7. A. ALIENUM *Swartz.*

Swz., Fl. Ind. Occ., p. 1595; Swz., Syn. Fil., p. 13; Hook., Sp. Fil., vol. V, p. 272; Hook. and Bak., Syn. Fil., p. 419; Hemsl., Biol. Cent. Am., vol. III, p. 683.

A. umbrosum, irregulare and *hastatum* Lieb., Mex. Breg., pp. 20–22.

Chrysodium alienum Mett., Fil. Hort. Bot. Lip., p. 21, pl. x, fig. 5; Eaton, Fil. Wr. et Fend., p. 196.

Gymnopteris aliena Swz.,—Smith, Hist. Fil., p. 138; Smith, Ferns, Br. and For., p. 118.

Gymnopteris irregularis Fourn., Sertum Nic., p. 250.

Common on the steep, rocky, wooded banks of the San Juan River, and rare in deep woods near Moyogalpa on Ometépe. The latter specimens are smaller. The specimens are typical and in fine fruit. Some of the sterile fronds seem to be proliferous. Several specimens from the banks of the Los Sabalos River resemble those from Ometépe, but the fertile pinnæ are shorter, blunter, and wider, and the margins of the sterile fronds are scarcely repand, being almost entire.

Reported from Chontales (as *G. irregularis*) by Fournier, and from Granada and Chontales by Hemsley.

8. A. NICOTIANÆFOLIUM *Swartz.*

Swz., Syn. Fil., pp. 13, 199; Hook., Sp. Fil., vol. v, p. 275; Hook. and Bak., Syn. Fil., p. 419.

Gymnopteris nicotianæfolia Presl, Tent. Pter., p. 244, pl. xi, fig. 6; Smith, Hist. Fil., p. 138; Smith, Ferns, Br. and For., p. 118.

Chrysodium nicotianæfolium Mett.,—Eaton, Fil. Wr. et Fend., p. 196.

A typical fertile frond was found on somewhat rocky banks along the La Juana River.

New to Nicaragua. Not reported in the *Biologia Cent. Am.* Baker[1] gives the distribution as from "Cuba to the Amazon Valley."

9. A. AUREUM *L.*

Linn., Syst. Nat., vol. ii, p. 686; Swz., Syn. Fil., p. 13; Presl, Rel. Haenk., p. 16; Presl, Tent. Pter., p. 241, pl. xi, fig. 3; Lieb., Mex. Breg., p. 20; Hook. Sp. Fil., vol. v, p. 266; Roth., Les Foug., vol. ii, p. 75, pl. xxvii; Bed., Ferns So. Ind., p. 69, pl. cciv; Hook. and Bak., Syn. Fil., p. 423; Smith, Ferns, Br. and For., p. 120; Eaton, Ferns N. Am., vol. ii, p. 93, pl. lviii; Underwood, Our Nat. Ferns and All., p. 80; Chapm , Fl. So. St., p. 588; Hemsl., Biol. Cent. Am., vol. iii, p. 683; Hitch., Pl. Bah., p. 157.

Chrysodium vulgare Fée,—Mett., Fil. Hort. Bot. Lip., p. 21.

Chrysodium aureum Mett.,—Eaton, Fil. Wr. et Fend., p. 196.

Chrysodium hirsutum Fée,—Fourn., Sertum Nic., p. 249.

---

[1] Syn. Fil. p. 419.

This well-known species was very common in brackish and fresh-water swamps at the mouth of the San Juan River near Greytown. It was in fine fruit.

It has been reported from the vicinity of Granada by Fournier (as *hirsutum*), and by Hemsley.

REPORTED SPECIES.

A. caudatum (Kze.) Hook.

Hemsl., Biol. Cent. Am., vol. III, p. 684, from Chontales.

A. melanopus Kze.

Fourn., Sertum Nic., p. 249; Hemsl., Biol. Cent. Am., vol. III, p. 687; both without exact locality.

Family XI. GRAMMITIDEÆ.

Genus HEMIONITIS *Linn.*

1. H. CITRIFOLIA (*L.*) *Hook.*

Hook., Sp. Fil., vol. V, p. 193; Hook. and Bak., Syn. Fil., p. 399; Hemsl., Biol. Cent. Am., vol. III, p. 682.

Acrostichum citrifolium L., Syst. Nat., vol. II, p. 685; Swz., Syn. Fil., p. 9; Mett., Fil. Hort. Bot. Lip., p. 19; Eaton, Fil. Wr. et Fend., p. 195.

Hemionitis parasitica L., Syst. Nat., p. 689.

Anetium citrifolium L, –Smith, Hist. Fil., p. 129; Smith, Ferns, Br. and For., p. 108; Fourn., Sertum Nic., p. 250.

The specimens in the collection distinctly show both the lines of sporangia along the veins, and the scattered clusters of sporangia between the veins.

The fronds are small, measuring from 1¼ to 5 inches in length. The stipes are very short, almost wanting in many of the specimens.

Common, creeping on the trunks of small trees in low woods near Castillo.

Reported from Chontales by Fournier (as *Anetium*), and by Hemsley.

2. H. PALMATA *L.*

Linn., Syst. Nat., vol. II, p. 689; Swz., Syn. Fil., p. 20; Hook., Ex. Fl., vol. I, pl. 33; Presl, Tent. Pter., p. 221, pl. IX, fig. 21; Lieb., Mex. Breg., p.

25; Hook., Sp. Fil., vol. v, p. 192; Roth., Les Foug., vol. II, p. 71, pl. XXV; Hook. and Bak., Syn. Fil., p. 398; Smith, Ferns, Br. and For., p. 129; Hemsl., Biol. Cent. Am., vol. III, p. 682.

Gymnogramme palmata Link,—Eaton, Fil. Wr. et Fend., p. 201.

A few typical, but small, specimens were found on a rocky hillside below the old fort at Castillo. Only two fertile fronds were collected.

New to the Nicaraguan list.

REPORTED SPECIES.

H. levyi Fourn.

Fourn., Bull. Soc. Bot. Fr., vol. XVII, p. 237; Fourn., Sertum Nic., p. 252; Hemsl., Biol. Cent. Am., vol. III, p. 682; all from Ometépe.

Genus GYMNOGRAMMA *Desv.*

1. G. PUMILA *Spreng.*

Kunze, Anal. Pterid., p. 11, pl. VIII, fig. 1; Hook., Sp. Fil., vol. v, p. 126; Hook. and Bak., Syn. Fil., p. 379; Hemsl., Biol. Cent. Am., vol. III, p. 678.

Hecistopteris pumila Smith, Hist. Fil., p. 178.

Numerous well-fruited specimens were found on a prostrate, rotten log near the La Juana River. The fronds were so closely crowded together that they formed a dense, moss-like covering on the log. Very few of the fronds reach a length of 1½ inches. Not heretofore reported from Nicaragua.

2. G. CALOMELANOS (*L.*) *Kaulf.*

Presl, Rel. Haenk., p. 17; Lieb., Mex. Breg., p. 58; Mett., Fil. Hort. Bot. Lip., p. 41; Eaton, Fil. Wr. et Fend., p. 200; Hook., Sp. Fil., vol. v, p. 148; Roth., Les Foug., vol. I, p. 117; Hook. and Bak., Syn. Fil., p. 384; Smith, Ferns, Br. and For., p. 125; Fourn., Sertum Nic., p. 251 (also two *vars.*); Hemsl., Biol. Cent. Am., vol. III, p. 676; Bak., Jour. Bot., vol. XXII, p. 364; Hitch., Pl. Bah., p. 157.

Acrostichum calomelanos L., Syst. Nat., p. 687; Swz., Syn. Fil., p. 15.

Ceropteris serrata Fée,—Fourn., Bull. Soc. Bot. Fr., vol. XVII, p. 236.

Very common near the foot of the volcano Ometépe, being gregarious on otherwise barren surfaces. Also on sides of bluffs of volcanic rock. The pinnules, segments, etc., are mostly very obtuse, being often dilated toward the apex, this probably being the form which Fournier reports from Granada as *Ceropteris serrata* Fée. He also reports the type from Chontales. Hemsley reports the species from Ometépe and Virgin Bay.

3. G. CALOMELANOS *var.* TARTAREA (*L.*) *Bom. et Ch.*

Bom. et Ch., Fil., p. 236.

Acrostichum tartareum L.,—Swz., Syn. Fil., pp. 15, 202.

G. tartarea Desv.,—Presl, Rel. Haenk., p. 17; Presl, Tent. Pter., p. 218, pl. IX, fig. 15; Lieb., Mex. Breg., p. 28; Mett., Fil. Hort. Bot. Lip., p. 41; Eaton, Fil. Wr. et Fend., p. 200; Hook., Sp. Fil., vol. V, p. 148; Hook. and Bak., Syn. Fil., p. 384; Smith, Ferns, Br. and For., p. 125; Hemsl., Biol. Cent. Am., vol. III, p. 679; Bak., Jour. Bot., vol. XXII, p. 364; Hitch., Pl. Bah., p. 157 (var. *ornithopteris*).

G. peruviana Desv.,—Mett., Fil. Hort. Bot. Lip., p. 41.

There seems to be no good reason for regarding this as other than a variety of *G. calomelanos*, the characters upon which the distinction is based being very variable.

The specimens, which were collected on rocky banks near Castillo and on the inner walls of the old fort, are almost typical, though the lobes, etc., are rather acute, and are made apparently more so by the turning in of the edges. It was found near Greytown, and along the Deseado River.

A series of rather immature specimens was also collected along the sandy shores of Lake Nicaragua on Ometépe. These are intermediate in division between *tartarea* and the more compound *calomelanos*, and have rather acute teeth.

The difference in texture seems to be due to surroundings. Both forms (*i. e.*, *calomelanos* and *tartarea*) are more coriaceous when growing in barren, exposed places.

Reported from Granada by Hemsley.

4. G. INCISA *Mart. et Lind.* Pl. XX, Figs. 3–5.

Hook., Sp. Fil., vol. V, p. 134; Hook. and Bak., Syn. Fil., p. 380.

A single plant, collected near the lake-shore on Ometépe, is in the collection. It has four fronds, only one of which shows the configuration of the entire frond (Fig. 3), the others being damaged at the apex. Because of insufficient material and lack of named specimens for comparison, the identification of the plant is not wholly satisfactory. The specimens agree well with Hooker's description, excepting that the stipes and the scales on the rootstock are dark-brown instead of blackish, and the stipes are shorter, measuring 1 to 2 inches. In some respects, namely in the color and length of the stipe, and in the flexuose frond, the specimen approaches *G. lindigii* Mett.,[1] but it will probably be necessary to unite several of the species of this group of the genus *Gymnogramma.*

The upper surface of the frond is but sparsely hairy, but the lower surface, like the stipe and rachis, is quite densely tomentose.

A few other plants were observed, but were not collected in time. They showed the same characters of surface, texture, division and size of the fronds, and a like laxity in habit of growth.

G. incisa has not been reported from Nicaragua, nor is it mentioned in the *Biol. Cent. Am.* The nearest locality from which it is reported is New Grenada.

Reported Species.

G. flexuosa (H. B. K.) Desv.

Hook., Sp. Fil., vol. v, p. 129; Hook. and Bak., Syn. Fil., p. 384; both without exact locality; Hemsl., Biol. Cent. Am., vol. III, p. 677, from Ometépe.

G. rufa (L.) Desv.

Fourn., Sertum Nic., p. 251, from Ometépe as *Neurogramme;* Hemsl., Biol. Cent. Am., vol. III, p. 678, from Granada.

Genus ANTROPHYUM *Kaulf.*

1. A. LANCEOLATUM (*L.*) *Kaulf.*

Lieb., Mex. Breg., p. 26; Eaton, Fil. Wr. et Fend., p. 197; Hook., Sp. Fil., vol. v, p. 176; Hook. and Bak., Syn. Fil., p. 394; Smith, Ferns, Br. and For., p. 130; Fourn., Sertum Nic., p. 250; Hemsl., Biol. Cent. Am., vol. III, p. 680; Hitch., Pl. Bah., p. 157; Bom. et Ch., Fil., p. 239.

Hemionitis lanceolata L., Syst. Nat., vol. II, p. 689.

Loxogramme lanceolata Presl, Tent. Pter., p. 215, pl. IX, fig. 8.

---

[1] Hook. and Bak., Syn. Fil., p. 381.

Common on the trunks and larger branches of trees near Castillo and along the La Juana River. The fronds are quite typical, except that most of them show slight marginal lobes, and a few are deeply palmately lobed toward the apex, with shorter lateral lobes below. The lobes are irregular, and some of the terminal divisions are long and narrow. The fruit was beginning to appear at the time of collecting.

Reported without locality by Fournier, and from Chontales by Hemsley.

2. A. SUBSESSILE *Kunze.*

Kunze, Analec. Pter., p. 29, pl. XIX, fig. 1; Eaton, Fil. Wr. et Fend., p. 197; Hook., Sp. Fil., vol. v, p. 171; Hook. and Bak., Syn. Fil., p. 394; Hemsl., Biol. Cent. Am., vol. III, p. 680; Bom. et Ch., Fil., p. 239.

The sori are abundantly anastomosing in the specimens in the collection.

Found on trees near Camp Menocal. Quite common.

Not heretofore reported from Nicaragua.

REPORTED SPECIES.

A. cayennense Kaulf.

Fourn., Sertum Nic., p. 250; Hemsl., Biol. Cent. Am., vol. III, p. 680; both from Chontales.

A. lineatum (Swartz) Kaulf.

Fourn., Sertum Nic., p. 250; Hemsl., Biol. Cent. Am., vol. III, p. 680; both without exact locality.

Genus MENISCIUM *Schreb.*

1. M. RETICULATUM (*L.*) *Swartz.*

Swz., Syn. Fil., p. 19; Eaton, Fil. Wr. et Fend., p. 201; Hook., Sp. Fil., vol. v, p. 165; Hook. and Bak., Syn. Fil., p. 392; Smith, Ferns, Br. and For., p. 137; Hemsl., Biol. Cent. Am., vol. III, p. 679; Hitch., Pl. Bah., p. 157; Bom. et Ch., Fil., p. 238.

Polypodium reticulatum L., Syst. Nat., vol. II, p. 692.

Common in low grounds along the San Juan and La Juana rivers near Castillo, and along the Deseado River near Camp Menocal. The pinnæ vary in the acuteness of the wedge-shaped base, and in the depth of the marginal crenations, some being almost entire. Some of the Camp Menocal and San Juan specimens approach *M. serratum*.

Not heretofore reported from Nicaragua.

Genus NOTHOLÆNA *R. Br.*

1. N. BRACHYPUS (*Kunze*) *J. Smith.*

Smith, Ferns, Br. and For., p. 172; Eaton, Proc. Am. Acad., vol. XVIII, p. 184; Hemsl., Biol. Cent. Am., vol. III, p. 673.

Cheilanthes squamosa Gill.,—Hook. et Grev., Icon. Fil., pl. CLI; Hook., Sp. Fil., vol. II, p. 81; Mett., Üb. Ein. Farng., pt. V, p. 22.

Cheilanthes brachypus Kze.,—Mett., Fil. Hort. Bot. Lip., p. 49; Mett, Üb. Ein. Farng., pt. V, p. 22; Fourn., Sertum Nic., p. 258.

Cheilanthes squamosa var. (?) *brachypus* Kze.,—Lieb., Mex. Breg., p. 105; Hook., Sp. Fil., vol. II, p. 115.

Nothochlæna squamosa Fée,—Hook. and Bak., Syn. Fil., p. 371.

Nothochlæna brachypus Kze.,—Smith, Hist. Fil., p. 279.

The stipes average less than an inch in length, while the fronds reach a length of 8½ inches and a width of 2 inches. But for the large size the fronds are typical. The lower surface of the frond, the stipe and rachis are densely coated with light brown scales. The rootstock is crested with a dense mass of long, linear scales of the same color.

This striking species was common on exposed volcanic rocks in very dry situations near the foot of the volcano Ometépe.

Reported (as *Cheilanthes*) from Ometépe by Fournier.

Family XII. VITTARIEÆ.

Genus MONOGRAMME *Schk.*

No specimens of this genus are in the collection, but the following are

REPORTED SPECIES.

M. immersa (Fée) Hook.

Hemsl., Biol. Cent. Am., vol. III, p. 675, without locality.

M. rostrata Hook.

Hook., Sp. Fil., vol. v, p. 122, from Ometépe; Hook. and Bak., Syn. Fil., p. 375, without locality; Hemsl., Biol. Cent. Am., vol. III, p. 675, from Ometépe.

Genus VITTARIA *Smith.*

1. V. LINEATA (*L.*) *Swartz.*

Swz., Syn. Fil., p. 109; Eaton, Fil. Wr. et Fend., p. 197; Hook., Sp. Fil., vol. v, p. 180; Hook. and Bak., Syn. Fil., p. 396; Underwood, Our Nat. Ferns and All., p. 86; Chapm., Fl. So. St., p. 589; Hemsl., Biol. Cent. Am., vol. III, p. 681; Bak., Biol. Cent. Am., vol. IV, p. 116 (from Costa Rica); Hitch., Pl. Bah., p. 157; Bom. et Ch., Fil., p. 239.

Pteris lineata L., Syst. Nat., vol. II, p. 687.

Haplopteris lineata Smith, Ferns, Br. and For., p. 132.

Not rare on trunks of trees in Greytown.

Reported from Nicaragua without exact locality by Hooker (*ibid.*)

Genus TAENITIS *Swartz.*

1. T. ANGUSTIFOLIA *R. Brown.*

Lieb., Mex. Breg., p. 27; Eaton, Fil. Wr. et Fend., p. 197; Hook., Sp. Fil., vol. v, p. 187; Hook. and Bak., Syn. Fil., p. 396; Hemsl., Biol. Cent. Am., vol. III, p. 681.

Pteris angustifolia Swz., Syn. F., p. 95.

Pteropsis angustifolia Desv.,—Presl, Tent. Pter., p. 225, pl. x, fig. 3; Smith, Ferns, Br. and For., p. 133.

Vittaria costata Kunze, Analec. Pter., p. 29, pl. XVIII, fig. 1 (a, b), 2; Fourn., Sertum. Nic., p. 258.[1]

Common on trees in deep woods near Castillo, and at Greytown. Well-fruited fronds vary from 3½ to 14 inches in length. Some of the fronds show a tendency to form lobes on the sides.

Reported from Chontales by Fournier (as *V. costata*) and by Hemsley.

2. T. FURCATA (*L.*) *Willd.*

Hook. et Grev., Icon. Fil., pl. VII; Eaton, Fil. Wr. et Fend., p. 197; Hook., Sp. Fil., vol. v, p. 188; Hook. and Bak., Syn. Fil., p. 397; Hemsl., Biol. Cent. Am., vol. III, p. 682; Bom. et Ch., Fil., p. 239.

---

[1] On authority of Hemsl., Biol. Cent. Am., vol. III, p. 681, Baker, in Syn. Fil., p. 395, places *V. costata* as a synonym under *V. gardneriana.*

Pteris furcata L., Syst. Nat., vol. II, p. 687; Swz., Syn. Fil., p. 95.

Dicranoglossum furcata (Willd.) Smith, Hist. Fil., p. 121; Smith, Ferns, Br. and For., p. 91.

Cuspidaria furcata Fée,—Fourn., Sertum Nic., p. 251.

Common on trunks of trees near Castillo.

Reported from Chontales by Fournier (as *Cuspidaria*), and by Hemsley.

Family XIII. POLYPODIEÆ.

Genus POLYPODIUM *L.* (*in part*).

I. P. PECTINATUM *L.*

Linn., Syst. Nat., vol. II, p. 691; Swz., Syn. Fil., p. 34; Presl, Tent. Pter., p. 178, pl. VII, fig 2; Lieb., Mex. Breg., p. 49; Mett., Üb. Ein. Farng., pt. I, p. 59; Eaton, Fil., Wr. et Fend., p. 198; Hook., Sp. Fil, vol. IV, p. 203; Roth., Les Foug., vol. I, p. 131, pl. X; Hook. and Bak., Syn. Fil., p. 333; Smith, Ferns, Br. and For., p. 78; Eaton, Ferns N. Am., vol. I, p. 317, pl. XLIII, figs. 1–3; Underwood, Our Nat. Ferns and All., p. 81; Chapm., Fl. So. St., p. 669; Hemsl., Biol Cent. Am., vol. III, p. 665; Bak., Biol. Cent. Am., vol. IV, p. 116 (from Costa Rica).

P. otites[1] L., Syst. Nat., vol. II, p. 691; Swz., Syn. Fil., p. 34.

P. paradiseæ L. et F.,—Mett., Fil. Hort. Bot. Lip., p. 31; Mett., Üb. Ein. Farng., pt. I, p. 60; Eaton, Fil. Wr. et Fend., p. 198.

P. consimile Mett.,—Eaton, Fil. Wr. et Fend., p. 198.

Phegopteris wagneri Mett.,—Fourn., Sertum Nic., p. 252.

Only three specimens were collected on a log near the La Juana River. These are typical.

Reported from Chontales by Fournier (as *Pheg. wagneri*), and by Hemsley.

2. P. SORORIUM *H. B. K.* Pl. XX, Fig. 14.

Mett., Üb. Ein. Farng., pt. I, p. 62; Eaton, Fil. Wr. et Fend., p. 198; Hook., Sp. Fil., vol. IV, p. 219; Hook. and Bak., Syn. Fil., p. 337; Smith, Ferns, Br. and For., p. 79; Fourn., Sertum Nic., p. 251; Hemsl., Biol. Cent. Am., vol. III, p. 669; Bom. et Ch., Fil., p. 224.

Growing on trunks of living trees in deep woods near

---

[1] There is doubt as to the correctness of referring this to *P. pectinatum*. If the reference is correct the name *otites* should be adopted, as it precedes *pectinatum* on the same page. See also Fourn., Bull. Soc. Bot. Fr., vol. XV, p. 116.

Castillo, along the La Juana River, and near Camp Menocal. The stipe and rachis are light slaty-bluish in color. The specimens are typical.

Reported from Chontales by Fournier, and by Hemsley.

3. P. PILOSELLOIDES *L.* var. CILIATUM (*Willd.*) *Bak.*

Hook. and Bak., Syn. Fil., p. 340.

P. ciliatum Willd.,—Presl, Rel. Haenk., p. 20.

Lopholepis ciliata Willd.,—Smith., Hist. Fil., p. 111; Smith, Ferns, Br. and For., p. 85.

As in most cases the variety was probably included with the type, the references which were consulted for the latter are also given:

P. piloselloides L., Syst. Nat., vol. 11, p. 691; Swz., Syn. Fil., p. 25; Mett., Üb. Ein. Farng., pt. 1, p. 93; Eaton, Fil. Wr. et Fend., p. 200; Hook., Sp. Fil., vol. V, p. 33; Hook. and Bak., Syn. Fil., p. 340; Hemsl., Biol. Cent. Am., vol. III, p. 666; Bak., Biol. Cent. Am., vol. IV, p. 116.

Marginaria piloselloides Presl, Tent. Pter., p. 187, pl. VII, fig. 24.

A slender, branching rootstock with one fertile and nineteen sterile fronds was collected on a tree near Castillo. This is clearly the variety. Several sterile fronds, in all respects like the Castillo specimens, were collected on a tile roof in San Carlos. Although no fertile fronds were observed, this is probably the same form.

The type (possibly including the *var.*) has been reported from Chontales by Hemsley. No specific record of the variety from Nicaragua seems to exist.

4. P. LORICEUM *L.* Pl. XX. Figs. 15, 16.

Linn., Syst. Nat., vol. II, p. 692; Swz., Syn. Fil., p. 35; Mett., Fil. Hort. Bot. Lip., p. 32, pl. XXIII, figs. 7–9; Mett., Üb. Ein. Farng., pt. 1, p. 76; Eaton, Fil., Wr. et Fend., p. 199; Hook., Sp. Fil, vol. V, p. 20; Hook. and Bak., Syn. Fil., p. 343; Hemsl., Biol. Cent. Am., vol. III, p. 663; Bak. Biol. Cent. Am., vol. IV, p. 116; Bak., Jour. Bot., vol. XXII, p. 364; Bom. et Ch., Fil., p. 221 (the last three from Costa Rica).

P. gonatodes Kze., Mett., Fil. Hort. Bot. Lip., p. 32, pl. XXIV, figs. 11, 12.

Goniophlebium loriceum L.,—Smith, Hist. Fil., p. 91; Smith, Ferns, Br. and For., p. 81.

P. lætum Raddi.,—Fourn., Sertum Nic., p. 252.

P. falcaria Kze.,—Fourn., Sertum Nic., p. 252.

Collected on trunks of trees along the La Juana River and near Camp Menocal. Most of the fronds have very obtuse pinnæ and a nearly smooth rachis, but a large frond, measuring nearly 2 feet in length, from Camp Menocal, has the pinnæ nearly acute, and the lower surface of the frond, the rachis and upper part of the stipe are quite brown-hairy. The rootstock is sparsely covered with peltate scales, and when fresh is fleshy and green.

Fournier lists it as *lætum* and *falcaria*,—the former from Chontales, the latter without locality. Hemsley reports it from Chontales.

5. P. NERIIFOLIUM *Schk.*

Swz., Syn. Fil., p. 37; Mett., Fil. Hort. Bot. Lip., p. 32; Mett., Üb. Ein. Farng., pt. I, p. 78; Eaton, Fil. Wr. et Fend., p. 199; Hook., Sp. Fil., vol. v, p. 28; Hook. and Bak., Syn. Fil., p. 345; Fourn., Sertum Nic., p. 252; Hemsl., Biol. Cent. Am., vol. III, p. 664; Bak., Biol. Cent. Am., vol. IV, p. 116 (from Costa Rica).

Goniophlebium neriifolium Schk.,—Smith, Hist. Fil., p. 92; Smith, Ferns, Br. and For., p. 82.

A single specimen, with mere suggestions of sori, was collected on a log near Camp Menocal. Fournier reports it from Ometépe, and Hemsley from Chontales.

6. P. ADNATUM (*Kunze*) *Hook.*

Mett., Üb. Ein. Farng., pt. I, p. 78; Hook., Sp. Fil., vol. v, p. 27; Hook. and Bak., Syn. Fil., p. 345; Hemsl., Biol. Cent. Am., vol. III, p. 653.

Goniophlebium adnatum Kze.,—Smith, Ferns, Br. and For., p. 295.

Two typical specimens in fine fruit were collected near Camp Seven. They are entirely smooth.

New to the Nicaraguan list.

7. P. POLYPODIOIDES (*L.*) *Hitch.*

Hitch., Pl. Bah., p. 156; Underwood, List of Pter. and Sperm., p. 9.

Acrostichum polypodioides L., Syst. Nat., p. 686.

P. incanum Swz., Fl. Ind. Occ., p. 1645; Swz., Syn. Fil., p. 35; Lieb., Mex. Breg., p. 37; Mett., Üb. Ein. Farng., pt. I, p. 69; Eaton, Fil. Wr. et Fend., p. 198; Hook., Sp. Fil., vol. IV, p. 209; Fourn., Bull. Soc. Bot. Fr., vol. XVII, p. 237; Hook. and Bak., Syn. Fil., p. 346; Williamson, Ferns of Ky., p. 37, pl. V; Eaton, Ferns N. Am., vol. I, p. 197, pl. XXVI, fig. 2;

Meehan, Nat. Fl. and Ferns of U. S., p. 13, pl. 4; Fourn., Sertum Nic., p. 252; Underwood, Our Nat. Ferns and All., p. 81; Chapm., Fl. So. St., p. 588; Hemsl., Biol. Cent. Am., vol. III, p. 660; Bak., Biol. Cent. Am., vol. IV, p. 116; Gray, Man. Bot., p. 680; Bom. et Ch., Fil., p. 224.

Marginaria incana Presl, Tent. Pter., p. 188, pl. VII, fig. 27.

Lepicystis incana Swz.,--Smith, Hist. Fil., p. 112; Smith, Ferns, Br. and For., p. 80.

This widely distributed species was rather common on tile roofs at San Carlos, and on fence-posts near Moyogalpa, Ometépe.

Reported (as *incanum*) from Ometépe by Fournier and Hemsley.

8. P. MACBRIDENSE nov. sp. Pl. XX, Figs. 6–9.

Rootstock short, rather slender, creeping, densely covered with broadly-ovate, entire or scarcely fimbriated white scales; *stipe* 1 to 2½ inches long, erect, rather stout, rigid, light-brown, densely covered with white peltate scales which are finally more or less deciduous: *rachis* similar to the stipe, but with the scales more persistent; *fronds* 3 to 9 inches long, ⅜ to ⅞ of an inch wide, pinnate to the apex, or the upper pinnæ very slightly connected; *pinnæ* spreading, very coriaceous, obtuse, 20 to 40 on a side, dilated at the base especially on the upper side, diminishing but slightly, if at all, downward, dark-green above, the color more or less obscured by white, peltate scales, the lower surface white with a dense covering of similar scales; the terminal pinna, or division, is narrow, somewhat caudate, obtuse, usually slightly dilated toward the apex, in length equal to or greater than the largest lateral pinnæ; *veins* obscure; *sori* in a single series about midway between the midrib and margin, in fully matured fronds almost covering the lower surface of the terminal half of the frond.

The scales, which densely cover all parts of the plant, are uniformly white (even in very young fronds), peltate toward the base, broadly lanceolate or ovate, and, excepting upon the rootstock, with the margin more or less deeply fimbriated, but none of them are hair-like. They are especially prominent on the lower surface of the frond, which they densely cover, their black centers giving it a punctate appearance.

The species belongs to the subgenus *Lepicystis* and is related to *P. lepidopteris*, from which it differs by the narrower and more perfectly pinnate frond which scarcely tapers downward, by the total absence of hairs and the uniform white color of the scales even in young fronds, and by the shorter, more slender rootstock.

Seven plants with thirteen fronds were collected on the larger branches of a Jicara-tree (*Crescentia cucurbitina* L.) which grew in a partial clearing opposite Castillo.

9. P. AUREUM *L.* var. AREOLATUM (*H. B. K.*) *Bak.*

Hook. and Bak., Syn. Fil., p. 347.

P. sporadocarpum Willd.,—Mett., Fil. Hort. Bot. Lip., p. 36; Mett., Üb. Ein. Farng., pt. I, p. 100.

P. areolatum H. B. K.,—Eaton, Fil. Wr. et Fend., p. 200; Lieb., Mex. Breg., p. 35; Bom. et Ch., Fil., p. 219.

Phlebodium areolatum Willd.,—Smith, Hist. Fil., p. 94; Smith, Ferns, Br. and For., p. 83.

Chrysopteris sporadocarpa Fée,—Fourn., Sertum Nic., p. 252.

In the following list of references for the type, those which clearly exclude the variety are omitted. In those which are given the variety may be, or certainly is, included.

P. aureum L., Syst. Nat., vol. II, p. 692; Swz., Syn. Fil., p. 32; Hook., Sp. Fil., vol. V, p. 16; Roth., Les Foug., vol. II, p. 25, pl. VI; Eaton, Ferns N. Am., vol. I, p. 115, pl. XVI; Underwood, Our Nat. Ferns and All., p. 82; Chapm., Fl. So. St., p. 588; Hemsl., Biol. Cent. Am., vol. III, p. 655; Bak., Jour. Bot., vol. XXII, p. 364 (var.).

Pleopeltis aurea Presl., Tent. Pter., p. 193, pl. VIII, fig. I.

A single fruiting specimen was collected on a fallen tree between Camp Menocal and the Divide.

Fournier reports the variety (as *C. sporadocarpa*) without exact locality. Hemsley reports *P. aureum*, also without locality, but probably refers to the same specimens as Fournier.

10. P. ANGUSTIFOLIUM *Swartz* var. ENSIFOLIUM (*Willd.*) *Bak.*

Hook. and Bak., Syn. Fil., p. 348.

P. ensifolium Willd.,—Presl, Rel. Haenk., p. 21.

Campyloneurum ensifolium Willd.,—Smith, Hist Fil., p. 96; Smith, Ferns, Br. and For., p. 101.

P. tæniosum H. B. K.,— Mett., Fil. Hort. Bot. Lip., p. 34, pl. XXIV, fig. 6, a, b; Mett., Üb. Ein. Farng., pt. I, p. 82, pl. I, figs. 52, 54, (in part); Eaton, Fil. Wr. et Fend., p. 199.

The following references to the type may, or do, include the variety.

P. angustifolium Swartz, Fl. Ind. Occ., p. 1627; Swz., Syn. Fil., p. 27; Lieb., Mex. Breg., p. 36; Hook., Sp. Fil., vol. V, p. 40; Hemsl., Biol. Cent. Am., vol. III, p. 654; Bak., Biol. Cent. Am., vol. IV, p. 116; Bom. et Ch., Fil., p. 231 (the last two from Costa Rica).

Campyloneuron dimorphum Fourn. var. *angustifolium* Fourn., Sertum Nic., p. 252.

A single plant with seven fronds was collected on a tile roof in the village of Castillo. The fruit is immature.

Reported (as *C. dimorphum* var. *angustifolium*) by Fournier without locality, and (as *P. angustifolium*) by Hemsley from Chontales. In neither case is the variety specifically mentioned, but may have been included with the type.

11. P. LÆVIGATUM *Cav.* Pl. XX, Fig. 10.

Swz., Syn. Fil., p. 28; Hook. and Bak., Syn. Fil., p. 348; Hemsl., Biol. Cent. Am., vol. III, p, 661; Bak., Jour. Bot., vol. XXII, p. 364.

P. lapathifolium Swz., Syn. Fil., p. 28.

Campyloneuron lanciforme Presl, Tent. Pter., p. 19, pl. VII, fig. 15.

Campyloneuron fasciale Presl, Tent. Pter., p. 190.

P. fasciale Willd.,—Mett., Üb. Ein. Farng., pt. I, p. 82; Hook., Sp. Fil., vol. V, p. 41.

Four plants were collected on a tree near Castillo. The rootstocks are short, dark-green when at length denuded of scales, and creeping. The stipes are crowded and very short or almost wanting.

The fronds measure 3¾ to 6 inches in length, and ⅝ to 1⅛ inches in width, and are oblanceolate or oblance-ovate in form. The veins are indistinct, but where traceable the venation is clearly that of *Campyloneuron*.

Reported from Nicaragua without exact locality by Hemsley.

12. P. REPENS *L.* Pl. XX, Fig. 11.

Swz., Fl. Ind. Occ., p. 1635; Swz., Syn. Fil., p. 29; Mett., Fil. Hort. Bot. Lip., p. 34, pl. XXIV, figs. 1–3; Eaton, Fil. Wr. et Fend., p. 199; Hook., Sp. Fil., vol. V, p. 39; Hook. and Bak., Syn. Fil., p. 348; Hemsl., Biol. Cent.

Am., vol. III, p. 668; Bak., Jour. Bot., vol XXII, p. 364; Bom. et Ch. Fil., p. 231; (the last two from Costa Rica).

P. cæspitosum Link,—Mett., Fil. Hort. Bot. Lip., p. 34, pl. XXIV, figs. 4, 5.

Campyloneurum repens L.,—Smith, Hist. Fil., p. 96; Smith, Ferns, Br. and For., p. 101.

Readily distinguished from *P. phyllitidis* by its more slender rootstock, stipe and frond, its thinner texture and more prominent venation, and by the undivided large areoles Its general aspect is very different.

Creeping on trunks of trees by the slender, wiry, black rootstock. Not rare near Camp Seven.

Reported from Nicaragua without exact locality by Hemsley.

13. P. PHYLLITIDIS *L.* Pl. XX. Figs. 12, 13.

Linn., Syst. Nat., vol. II, p. 691; Swz., Syn. Fil., p. 28; Lieb., Mex. Breg., p. 42; Mett., Fil. Hort. Bot. Lip., p. 34; Hook., Sp. Fil., vol. V, p. 38; Roth., Les Foug., vol. II, p. 17, pl. III; Hook. and Bak., Syn., Fil., p. 348; Eaton, Ferns N. Am., vol. I, p. 321, pl. XLII, figs. 4–7; Underwood, Our Nat. Ferns and All., p. 82; Chapm., Fl. So. St., p. 588; Hemsl., Biol. Cent. Am., vol. III, p. 665; Bom. et Ch., Fil., p. 231.

Campyloneuron phyllitidis Presl, Tent. Pter., p. 190, pl. VII, figs. 18–20; Fourn., Sertum Nic., p. 252.

Campyloneurum phyllitidis Presl,—Smith, Hist. Fil., p. 96; Smith, Ferns, Br. and For., p. 102.

P. repens Mett., Fil. Hort. Bot. Lip., p. 34, pl. XXIV, fig. 12.

Quite common on the trunks and larger branches of trees. The specimens from the vicinity of Castillo, the La Juana River, and Greytown are of the large glossy, rather short-stiped type. A few fronds, from a tile roof in the village of Castillo, are rather small, with long slender stipes.

Another form, growing on trees in a partial clearing near Castillo, has small, narrow, acuminate and acute, opaque, long-stiped fronds. These measure 7 to 10 inches in length, and 1 to 1½ inches in width; the stipe is 2½ to 3½ inches long. The venation of this form is that of typical *phyllitidis* with the large areoles usually divided by a single median vein, whereas in the large glossy form there are more frequently three rows of secondary areoles between the main veins (see figures).

Hooker (*ibid.*) reports it from Nicaragua without locality, and Fournier and Hemsley both report it from Chontales. Bommer and Christ list it from San Juan del Norte (Greytown). It is used as a remedy for fever by the natives.

14. P. PERCUSSUM *Cav.*

Swz., Syn. Fil., p. 26; Mett., Fil. Hort. Bot. Lip., p. 36, pl. XXV, fig. 3; Mett., Üb. Ein. Farng., pt. I, p. 90; Hook., Fil. Ex., pl. LIX; Eaton, Fil. Wr. et Fend., p. 200; Hook., Sp. Fil., vol. V, p. 55; Hook. and Bak., Syn. Fil., p. 356; Hemsl., Biol. Cent. Am., vol. III, p. 665; Bak., Jour. Bot., vol. XXII, p. 364.

P. cuspidatum Presl, Rel. Haenk., p. 20, pl. I, fig. 3.

P. stigmaticum Presl, Rel. Haenk., p. 20, pl. III, fig. 3.

Pleopeltis percussa Hook. et Grev., pl. LXVII; Presl, Tent. Pter., p. 193, pl. VII, fig. 35; Smith, Hist. Fil., p. 114; Smith, Ferns, Br. and For., p. 86; Fourn., Sertum Nic., p. 252.

Phymatodes percussum Cav.,—Bom. et. Ch., Fil., p. 232.

Common on trunks of trees in partial clearings near Castillo. Specimens were also collected on a tile roof in the village of Castillo. In fine fruit. The fronds vary from 3 to 10 inches in length, and from 3/8 to 1 inch in width. The smaller forms are almost sessile, or with very short stipes, and the fruit is restricted in most of them to the terminal half of the frond. The larger specimens have stipes quite 2 inches long, and the sori in some of them extend nearly to the base.

The sterile fronds are shorter and broader. Free veinlets occur in some of the areolæ.

Reported from Chontales by Fournier (as *Pleopeltis*), and by Hemsley.

15. P. LYCOPODIOIDES *L.*

Linn., Syst. Nat., vol. II, p. 691; Swz., Syn. Fil., p. 25; Lieb., Mex. Breg., p. 34; Mett., Fil. Hort. Bot. Lip., p. 36, pl. XXV, fig. 4; Mett., Üb. Ein. Farng., pt. I, p. 97; Hook., Sp. Fil., vol. V, p. 34; Hook. and Bak., Syn. Fil., p. 357; Hemsl., Biol. Cent. Am., vol. III, p. 663.

Pleopeltis lycopodioides Presl, Tent. Pter., p. 193, pl. VIII, figs. 3, 4.

Pleopeltis squamulosa Presl, Tent. Pter., p. 193.

Anapeltis lycopodioides L.,—Smith, Hist. Fil., p. 116; Smith, Ferns, Br. and For., p. 86.

Phymatodes lycopodioides L., Bom. et Ch., Fil., p. 233.

Rather common on trees near Castillo and Greytown. Most of the fronds are sessile. Some of the specimens from Castillo are typical, while others, and those from Greytown are the var. *salicifolium* Willd.[1] The relative size and form of the fertile and sterile fronds are so variable, however, that the varietal character has but little value.

Not heretofore specifically reported from Nicaragua, though listed from Panama and Guatemala.

16. P. CRASSIFOLIUM *L.*

Linn., Syst. Nat., vol. II, p. 691; Swz., Syn. Fil., p. 27; Presl, Rel. Haenk., p. 20; Lieb., Mex. Breg., p. 41; Mett., Fil. Hort. Bot. Lip., p. 37, pl. XX, figs. 5, 6; Mett., Üb. Ein. Farng., pt. I, p. 109; Eaton, Fil. Wr. et Fend., p. 200; Hook., Sp. Fil., vol. V, p. 62; Hook. and Bak., Syn. Fil., p. 360; Hemsl., Biol. Cent. Am., vol. III, p. 656; Bak., Biol. Cent. Am., vol. IV, p. 116.

Phymatodes crassifolia Presl, Tent. Pter., p. 197, pl. VIII, fig. 9; Bom. et Ch., Fil., p. 232.

Pleuridium crassifolium L., Smith, Hist. Fil., p. 95; Smith, Ferns, Br. and For., p. 95.

Common on trees near Castillo, Greytown, and Camp Menocal.

The fronds vary from 9½ to 25 inches in length, and from 1 to 3½ inches in width. Some of the fronds are quite sessile. The apex varies from broadly rounded to abruptly and narrowly acuminate. The sori are in 4 to 10 rows on each side of the midrib, and in the narrower, very obtuse forms, they are closely crowded. A few fronds have obscure lobes toward the apex.

Not heretofore recorded from Nicaragua, the nearest reported station being Panama.

REPORTED SPECIES.

P. attenuatum H. B. K.

Fourn., Bull. Soc. Bot. Fr., vol. XVII, p. 237, from Granada; Fourn., Sertum Nic., p. 251, without locality; Hemsl., Biol. Cent. Am., vol. III, p. 655, without locality.

P. cardiophyllum (Presl).

Fourn., Sertum Nic., p. 252 (as *Craspedaria*).

Under the name *C. cardiophylla* Fournier reports a *Poly-*

---

[1] See Hook. and Bak., Syn. Fil., p. 357.

podium from Chontales. The author is unable to determine just what this is. Fournier himself says of it: "*Marginaria* Presl, *Tent.* 188? *Polypodium cordatum* Desv. *Ann. Linn.* VI, 226? non Kze., certe non *Craspedaria cordifolia* Fée *Crypt. Brés.* 118, tab. 36, f. 1."

P. chnoodes Spreng.

Hemsl., Biol. Cent. Am., vol. III, p. 656, from Chontales.

P. coarctatum Kunze.

Fourn., Sertum Nic., p. 252 (as *Campyloneuron*); Hemsl., Biol. Cent. Am., vol. III, p. 656; both from Chontales.

P. cultratum Willd.

Fourn., Sertum Nic., p. 251 (as *P. elasticum* Bory) from Ometépe, and also a set without exact locality.

P. elasticum Rich.

Fourn., Sertum Nic., p. 251 (as *P. plumula* Willd.), from Chontales; Hemsl., Biol. Cent. Am., vol. III, p. 657, from Chontales and Ometépe.

P. friedrichsthalianum Kunze.

Hemsl., Biol. Cent. Am., vol. III, p. 658, from Chontales.

P. kuhnii Fourn.

Fourn., Sertum Nic., p. 251; Hemsl., Biol. Cent. Am., vol. III, p. 661; both from Ometépe.

P. lanceolatum L.

Hemsl., Biol. Cent. Am., vol. III, p. 661, from Chontales.

P. plesiosorum Kunze.

Fourn., Sertum Nic., p. 251 (as *P. anisomeron* Fée, var.) from Granada, and p. 252 (as *P. rhodopleurum* Fée) without exact locality.

P. pruinatum Bak.

Hook. and Bak., Syn. Fil., p. 508; Hemsl., Biol. Cent. Am., vol. III, p. 667; both from Chontales.

P. puberulum Ch. et Schl.

Hemsl., Biol. Cent. Am., vol. III, p. 667, from Chontales.

P. serrulatum Mett.

Fourn., Sertum Nic., p. 251 (as *Xiphopteris serrulata* Kaulf.), without locality; Hemsl., Biol. Cent. Am., vol. III, p. 669, from Chontales.

P. trichomanoides Swartz.

Hemsl., Biol. Cent. Am., vol. III, p. 671, from Chontales.

P. truncicola Klotzsch.

Hemsl., Biol. Cent. Am., vol. III, p. 671, from Chontales.

P. vacciniifolium F. et L.

Fourn., Sertum Nic., p. 252, (as *Craspedaria*); Hemsl., Biol. Cent. Am., vol. III, p. 671; both from Chontales; Bom. et Ch., Fil., p. 222, from Nicaragua without locality.

Sub-class II. EUSPORANGIATÆ.

Sub-order II. MARATTIACEÆ.

Genus MARATTIA *Smith.*

No species of the genus were observed, but the following is a

REPORTED SPECIES:

M. alata Smith.

Fourn., Sertum Nic., p. 261, (as *M. weinmanniæfolia* Lieb.); Hemsl., Biol. Cent. Am., vol. III, p. 696; both without exact locality.

Genus DANÆA *Smith.*

1. D. ELLIPTICA *Smith.*

Hook. et Grev., pl. LII (the text, however, is headed pl. LI); Eaton, Fil. Wr. et Fend., p. 217. Hook. and Bak., Syn. Fil., p. 444; Hemsl., Biol. Cent. Am., vol. III, p. 697; Bom. et Ch., Fil., p. 248.

D. media Lieb., Mex. Breg., p. 154.

A single sterile frond was found in deep woods near Castillo. A comparision with authentic specimens, and with the descriptions cited, leaves no doubt concerning the correctness of the identification.

Not reported from Nicaragua, the nearest published locality being Panama.

2. D. CRISPA *End. et Reich.* Pl. XX, Fig. 17.

Hook. and Bak., Syn. Fil., p. 525; Hemsl., Biol. Cent. Am., vol. III, p. 696; Bom. et Ch., Fil., p. 249.

One sterile frond was collected in deep woods near Camp Menocal. It is typical in every character. The species has heretofore been reported only from Costa Rica.

REPORTED SPECIES.

D. moritziana Presl.

Hemsl., Biol. Cent. Am., vol. III, p. 697, from Chontales.

ADDENDUM.

SINCE the first forms of this paper were printed, a number of additional reference-works have been received. While these were not consulted for the earlier determinations as they appear in the paper, they were so employed in the latter part of the work, and in order that the references to the Nicaraguan species discussed in these works may be complete as far as possible, the following additional list of references, which should have appeared under the species listed, is here appended. For convenience the genera and species are alphabetically arranged. The ferns listed in Bommer and Christ's paper are from Costa Rica, unless otherwise specified.

ACROSTICHUM.

A. *alienum* Swz., p. 187.
Bom. et Ch., Fil., p. 246.

A. *aureum* L., p. 188.
Bom. et Ch., Fil., p. 247.

A. *osmundaceum* (H. B. K.) Hook., p. 186.
Bom. et Ch., Fil., p. 246.

A. *peltatum* Swz., p. 187.
Bom. et Ch., Fil., p. 242.

A. *sorbifolium* L., p. 186.
Bom. et Ch., Fil., p. 243.

ADIANTUM.

A. *concinnum* H. B. K., p. 149.
Bom. et Ch., Fil., p. 188.

A. *macrophyllum* Swz., p. 146.
Bom. et Ch., Fil., p. 185.

A. *obliquum* Willd. p., 142.
Bom. et Ch., Fil., p. 186.
  A. *intermedium* Swz.—Bom. et Ch., Fil., p. 186.
  A. *kaulfussii* Kze.—Bom. et Ch., Fil., p. 186.

A. *platyphyllum* Swz., p. 147.
  A. *seemanni* Hook.—Smith, Ferns, Br. and For., p. 310; Bom. et Ch., Fil., p. 185, from Nicaragua, without exact locality.

A. *pulverulentum* L., p. 148.
Bom. et Ch., Fil., p. 187.

A. tenerum Swz., p. 149.
Bom. et Ch., Fil., p. 187.

A. tetraphyllum Willd., p. 146.
Bom. et Ch., Fil., p. 186.

A. trapeziforme L., p. 145.
Bom. et Ch., Fil., p. 185.

ASPIDIUM.

A. trifoliatum (L.) Swz., p. 181.
Bom. et Ch., Fil., p. 206.

ASPLENIUM

A. auritum Swz., p. 159.
Bom. et Ch., Fil., p. 198.

A. cultrifolium L., p. 159.
Bom. et Ch., Fil., p. 196.

A. formosum Willd., p. 160.
Bed., Ferns S. Ind., p. 46, pl. CXXXVI; Bom. et Ch., Fil., p. 195.

A. lunulatum var. *proliferum* (Swz.) Mett., p. 158.
A. erectum Bory.—Mett., Üb. Ein. Farng., pt. VI, p. 122.
A. lunulatum Swz.—Bom. et Ch., Fil., p. 195.

A. plantagineum L., p. 162.
Bom. et Ch., Fil., p. 199.

A. pumilum Swz., p. 162.
Bom. et Ch., Fil., p. 194.

A. serra L. et F., p. 159.
Bom. et Ch., Fil., p. 197.

A. serratum L., p. 157.
Bom. et Ch., Fil., p. 194.

A. shepherdi Spreng., p. 164.
Bom. et Ch., Fil., p. 201.

BLECHNUM.

B. longifolium H. B. K., p. 155.
Smith, Ferns, Br. and For., p. 198; Bom. et Ch., Fil., p. 193.
B. intermedium Link.—Bom. et Ch., Fil., p. 193.

B. occidentale L., p. 156.
Bom. et Ch., Fil., p. 192.

B. volubile Kaulf., p. 157.
Bom. et Ch., Fil., p. 194.

DAVALLIA.

D. inequalis Kze., p. 153.

Bom. et Ch., Fil., p. 181; from Nicaragua without exact locality.

DICKSONIA.

D. rubiginosa Kaulf., p. 154.

Bom. et Ch., Fil., p. 180.

GLEICHENIA.

G. pubescens (H. B. K.) H. & G., p. 135.

Smith, Ferns, Br. and For., p. 249.

GYMNOGRAMMA.

G. calomelanos (L.) Kaulf., p. 190.

Bom. et Ch., Fil., p. 236.

G. flexuosa (H. B. K.) Desv., p. 192.

Bom. et Ch., Fil., p. 234; without exact locality.

HEMIONITIS.

H. palmata L., p. 189.

Bom. et Ch., Fil., p. 239.

HEMITELIA.

H. grandifolia (Willd.) Spreng., p. 167.

Bom. et Ch., Fil., p. 176.

HYMENOPHYLLUM.

H. ciliatum Swz., p. 128.

Swz., Fl. Ind. Occ., p. 1753; Swz., Syn. Fil., p. 147; Lieb., Mex. Breg., p. 140; Smith, Ferns, Br. and For., p. 251; Bom. et Ch., Fil., p. 182.

H. polyanthos Swz., p. 127.

Swz., Fl. Ind. Occ., p. 1757; Swz., Syn. Fil., p. 149; Lieb., Mex. Breg., p. 139; Smith, Ferns, Br. and For., p. 250; Bom. et Ch., Fil., p. 183.

HYPOLEPIS.

H. repens (L.) Presl, p. 142.

Mett., Fil. Hort. Bot. Lip., p. 81, pl. XVI, fig. 7; Eaton, Fil. Wr. et Fend., p. 207; Roth., Les Foug., vol. II, p. 49, pl. XV; Smith, Ferns, Br. and For., p. 171; Bom. et Ch., Fil., p. 185.

LINDSAYA.

L. trapeziformis Dry., p. 151.

Bom. et Ch., Fil., p. 185.

LYGODIUM.

L. venustum Swz.

Swz., Syn. Fil., pp. 153, 383; Lieb., Mex. Breg., p. 146; Presl, Sup. Tent. Pter., p. 105; Bom. et Ch., Fil., p. 248.

NEPHRODIUM.

N. cicutarium (L.) Bak., p. 178.

Aspidium cicutarium Swz.—Bom. et Ch., Fil., p. 206.

N. conterminum (Willd.) Desv., p. 172.

Aspidium conterminum Willd.—Bom. et Ch., Fil., p. 211.

Aspidium conterminum var. *pilosulum* (Kl. et Karst.). —Bom. et Ch., Fil., p. 212.

N. effusum (Swz.) Bak., p. 175.

Aspidium effusum Swz.—Bom. et Ch., Fil., p. 214.

N. macrophyllum (Swz.) Bak., p. 179.

Aspidium macrophyllum Swz.—Bom. et Ch., Fil., p. 208.

N. mexicanum Presl, p. 173.

Aspidium patulum Bak.—Bom. et Ch., Fil., p. 214.

N. parasiticum (L.) Shimek, p. 176.

Aspidium molle Desv.—Bom. et Ch., Fil., p. 209.

N. skinneri Hook, p. 176.

Aspidium harrisoni Bak.—Bom. et Ch., Fil., p. 209.

NEPHROLEPIS.

N. acuta (Schk.) Presl, p. 171.

Bom. et Ch., Fil., p. 215.

N. cordifolia (L.) Presl, p. 171.

Bom. et Ch., Fil., p. 215.

OLEANDRA.

O. nodosa Presl, p. 170.

Bom. et Ch., Fil., p. 206.

PHEGOPTERIS.

P. crenata (Swz.) Mett., p. 183.

Polypodium crenatum Swz.—Bom. et Ch., Fil., p. 218.

P. decussata (L.) Mett., p. 182.

Polypodium decussatum L.—Bom. et Ch., Fil., p. 217.

P. punctata (Thunb.) Mett., p. 182.

Polypodium punctatum Thunb.—Bom. et Ch., Fil., p. 215.

P. tetragona (Swz.) Mett., p. 183.

Polypodium tetragonum Swz.—Bom. et Ch., Fil., p. 218.

Polypodium tetragonum var. *megalodus* (Schk.),—Bom. et Ch., Fil., p. 218.

PTERIS.

P. aculeata Swz., p. 139.

Swz., Fl. Ind. Occ., p. 1601; Swz., Syn. Fil., p. 100.

P. biaurita L., p. 136.

Swz., Syn. Fil., p. 98; Roth., Les Foug., p. 157, pl. XXI.

P. nemoralis Willd.,—Lieb., Mex. Breg., p. 74; Mett., Fil. Hort. Bot. Lip., p. 57.

P. quadriaurita Retz.,—Smith, Ferns, Br. and For., p. 190; Bom. et Ch., Fil., p. 189.

Litobrochia biaurita Smith, Ferns, Br. and For., p. 194.

P. quadriaurita var. *biaurita* (L.), Bom. et Ch., Fil., p. 190.

P. elata Ag., p. 141.

Litobrochia elata Smith, Ferns, Br. and For., p. 193; Bom. et Ch., Fil., p. 192.

P. hirsuta (L.) Hook., p. 139.

Lonchites hirsuta L.,—Swz., Syn. Fil., p. 93.

P. laciniata Willd.,—Presl, Tent. Pter., p. 146; Lieb., Mex. Breg., p. 75; Smith, Ferns, Br. and For., p. 191; Bom. et Ch., Fil., p. 191.

P. incisa Thunb., p. 140.

Bom. et Ch., Fil., p. 192.

TRICHOMANES.

T. brachypus Kze., p. 132.

Smith, Ferns, Br. and For., p. 322; Bom. et Ch., Fil., p. 184.

T. crispum L., p. 133.

Swz., Syn. Fil., p. 142; Smith, Ferns, Br. and For., p. 254; Bom. et Ch., Fil., p. 184.

T. elegans Rudge., p. 129.

Bom. et Ch., Fil., p. 185.

Hymenostachys elegans Presl,—Smith, Ferns, Br. and For., p. 257.

T. krausii H. & G., p. 131.

Smith, Ferns, Br. and For., p. 253.

Didymoglossum krausii Presl,—Fourn., Bull. Soc. Bot. Fr., vol. XIX, p. 241.

T. membranaceum L., p, 129.

Swz., Fl. Ind. Occ., p. 1724; Swz., Syn. Fil., p. 141; Hook., Ex. Fl., pl. 76; Kunze, Die Farrnk., p. 212, pl. LXXXVIII, fig. 1; Smith, Ferns, Br. and For., p. 252.

Lecanium membranaceum Presl, Hymen., p. 12, pl. I, figs. 1–12; Fourn., Bull. Soc. Bot. Fr., vol. XV, p. 144.

T. pinnatum Hedw., p. 134.

Swz., Syn. Fil., p. 142; Bom. et Ch., Fil., p. 184.

Neurophyllum pinnatum Presl, Hymen., p. 19, pl. IV C; Lieb., Mex. Breg., p. 144; Smith, Ferns, Br. and For., p. 254; in the two latter as *pennatum*.

T. prieurii Kze., p. 134.

Smith, Ferns, Br. and For., p. 254 (as *leprieurii*); Bom. et Ch., Fil., p. 184.

T. punctatum Poir., p. 129.

Smith, Ferns, Br. and For., p. 252.

T. reptans Swz., Fl. Ind. Occ., p. 1727; Swz., Syn. Fil., p. 142; Lieb., Mex. Breg., p. 142; Smith, Ferns, Br. and For., p. 253.

T. sphenoides Kze., Die Farrnk., p. 215, pl. LXXXVIII, fig. 2. (Kunze places *T. reptans, punctatum* and *hookeri* in the synonymy of *T. sphenoides*).

Didymoglossum punctatum Presl,—Fourn., Bull. Soc. Bot. Fr., vol. XIX, p. 239.

Didymoglossum sphenoides Presl,—Fourn., Bull. Soc. Bot. Fr., vol. XIX, p. 239. With this is included var. *genuina* Fourn. (= *D. laceratum* Fée,= *T. reptans* H. & G.).

Didymoglossnm reptans Presl,—Fourn., Bull. Soc. Bot. Fr., vol. XIX, p. 240.

T. pusillum Swz. (possibly including the var.), p. 130.

Swz., Fl. Ind. Occ., p. 1729; Swz. Syn. Fil., p. 142; Smith, Ferns, Br. and For., p. 253.

Hemiphlebium pusillum Swz., –Presl, Hymen., pl. IX, figs. 1–3.

T. pyxidiferum L., p. 132.

Swz., Syn. Fil., p. 143; Lieb., Mex. Breg., p. 143; Smith, Ferns, Br. and For., p. 253.

T. radicans Swz., p. 132.

Swz., Fl. Ind. Occ., p. 1729; Swz., Syn. Fil., p. 143; Presl, Hymen., p. 16, pl. II β; Smith, Ferns, Br. and For., p. 253; Bom. et Ch., Fil., p. 184.

These additional references necessitate the following corrections and additions:

1. The following species, reported in this paper on the page opposite each name as not occurring in Central America, are given in Bommer and Christ's recent list from Costa Rica. They are, however, new to Nicaragua.

Acrostichum osmundaceum (H. B. K.) Hook., p. 187.
Phegopteris punctata (Thunb.) Mett., p. 182.
Trichomanes brachypus Kze., p. 132.
Trichomanes prieurii Kze., p. 134.

2. The following species, similarly reported as new to Nicaragua, are given in Bommer and Christ's list as occurring in Nicaragua (without exact locality). The correction should be made on the page opposite each name.

Adiantum platyphyllum Swz. (as *seemanni*), p. 147.

Adiantum obliquum Willd. (the var. *intermedium* reported by Bom. et Ch. as a species), p. 145.

Davallia inequalis Kze., p. 153.

3. *Trichomanes membranaceum* L., recorded by mistake on p. 129 as new to the Central American region, is listed by Fournier as *Lecanium membranaceum* Presl, in Bull. Soc. Bot. Fr., vol XV, p. 144.

4. The form of *Nephrodium conterminum* (Willd.) Desv. described on p. 173 as "copiously clothed with white hairs," is probably the same as *Aspidium conterminum* var. *pilosulum* (Kl. et. Karst.) Bom. et Ch. of Bommer and Christ's list.

5. The following more exact data may be of interest in connection with the discussion on p. 120.

The total number of species and varieties collected in Nicaragua by the author, and reported in this paper, is 126, representing 32 genera. This number does not, however, include the forms of *Pteris biaurita*, *Adiantum obliquum*, etc., which might be considered varieties.

Of these 1 is a new species, 7 are new to Central America, and 37 are new to Nicaragua, none of these species being counted twice.

The following table shows the distribution of the species and varieties which were collected:

Peculiar to Ometépe,	10 species
Peculiar to Castillo and vicinity,	52 species
Peculiar to Greytown and vicinity,	38 species
Found at Greytown and Ometépe,	1 species
Found at Greytown and Castillo,	14 species
Found at Ometépe and Castillo,	5 species
Found at Castillo and Boca del Rama,	1 species
Found at Castillo and San Carlos,	1 species
Found at Ometépe and San Carlos,	1 species
Found at Greytown, Castillo and Ometépe,	1 species
Found at all the points mentioned excepting San Carlos,	2 species

The last two species are *Nephrodium conterminum* and *N. cicutarium.* The latter should have been included with *Gymnogramma* var. *tartarea* on p. 120, making *three* species common to the three points mentioned. It presents so much variation (viz., pp. 178–9) that at first the author regarded the extremes as distinct species.

In habit 81 of the species are terrestrial, 43 are epiphytic, and 2 have adopted both habits.

In addition to the species collected by the author there are included in this paper 72 species, representing 7 genera, which have been reported by various authors from Nicaragua,—the majority of the forms being from the mountainous districts of Chontales. These were added for the purpose of making the Nicaraguan record as complete as possible up to the present time.

The total number of species and varieties, reported in this paper from Nicaragua from all sources, is 198, representing 39 genera.

That a more thorough survey of that country will materially increase the number is evident from the experience of collectors in adjacent regions.

ERRATA.

Page 126.—In footnote 1 substitute "*Alsophila*" for "*Hemitelia*."

Page 135.—Under *L. venustum* omit fig. 3, and add fig. 5.

Page 143.—In footnote 2 instead of "fig. 2" read "fig. 11."

Page 145.—"Swartz" after var. *intermedium* in line 9 should be in parenthesis, as the combination is not Swartz's, but the author's.

Under *A. trapeziforme* substitute "*Syn. Fil.*" for "*Fl. Ind. Occ.*"

Page 153.—After line 15 add: "Found along the La Juana River. Rather common. New to Nicaragua."

Page 162.—After *A. pumilum* Swartz omit "Pl. xv, fig. 6."

Page 184.—In line 20 for "*draconopterum*" read *draconoptera.*

Page 198.—In line 27 after "collected" add "on trees."

BIBLIOGRAPHY.

The following list includes the titles of all works consulted by the author for purposes of identification, or for the determination of geographical distribution or of synonymy. A large quantity of herbarium material, chiefly from Mexico, the West Indies, and South America, was used for the same purposes.

A list of references, arranged chronologically, is given under each species in the foregoing paper to show just what basis there is for each determination. The abbreviations used for that purpose are arranged alphabetically in the following list, followed by the full title of the book or paper.

Bak., Biol. Cent. Am., vol. iv.—J. G. Baker, Biologia Centrali-Americana, Botany, vol. iv.—"Costa Rican Ferns," pp. 115-6.—1887.

Bak., Jour. Bot., vol. xxii.—J. G. Baker, Journal of Botany, vol. xxii.—"Ferns collected in Costa Rica by Mr. P. G. Harrison," pp. 362–4.—1884.

Bak., On Rec. Syn. Braz. F.—J. G. Baker, "On the Recent Synonymy of Brazilian Ferns."—1873.

Bak., Sum. New Ferns.—J. G. Baker, Annals of Botany, vol. v.—"A Summary of New Ferns, 1874–'91."—1891.

Bed., Ferns S. Ind.—Major R. H. Beddome, Ferns of Southern India.—2nd edition,—1873.

Bom. et Ch., Fil.—J. E. Bommer et H. Christ, Bulletin de la Société Royale de Botanique de Belgique, vol. xxxvi.—Filices in "Primitiæ Floræ Costaricensis," pp. 167–249.—1896.

Chapm., Fl. So. St.—A. W. Chapman, Flora of the Southern States.—2nd edition,—1883.

Eaton, Ferns N. Am.—D. C. Eaton, Ferns of North America, vols. i, ii.—1879.

Eaton, Fil. Wr. et Fend.—D. C. Eaton, Memoirs of the American Academy of Sciences and Arts, New Series, vol. viii.—"Filices Wrightianæ et Fendlerianæ," pp. 193–218.—1860.

Eaton, Proc. Am. Acad., vol. xviii.—D. C. Eaton, Proceedings of the American Academy, vol. xviii. 1883.
"List of Plants from Southwestern Texas and Northern Mexico."—Ferns, pp. 183–189.

Fourn., Bull. Soc. Bot. Fr., vol. xv.—Eug. Fournier, Bulletin de la Société de Botanique de France, vol. xv.—1868.
A note on *Polypodium*, p. 116.
"Sur les Hyménophyllées Recueillies dans L'Amerique Centrale, par MM. Ch. Wright, Fendler et Th. Husnot,"—pp. 143–8.

Fourn., Bull. Soc. Bot. Fr., vol. xvii.—Eug. Fournier, *ibid.*, vol. xvii.—1870.
"Sur Deux Fougères Nouvelles du Nicaragua,"—pp. 236–7.

Fourn., Bull. Soc. Bot. Fr., vol. xix.—Eug. Fourn., *ibid.*, vol. xix.—1880.
"Sur les Hyménophyllées Recueillies dans l'Amerique Centrale par MM. Ch. Wright, Fendler et Th. Husnot,"—pp. 239–41.

Fourn., Sertum Nic.—Eug. Fournier, *ibid.*, vol. xix.—1880.
"Sertum Nicaraguense,"—pp. 247-62.

Gray, Man. Bot.—A. Gray, Manual of Botany, 6th edition,—1890.

Hemsl., Biol. Cent. Am., vol. iii.—W. B. Hemsley, Biologia Centrali-Americana, Botany; vol. iii.—1885.
"Filices," pp. 589–697.

Hitch., Pl. Bah.—A. S. Hitchcock, Fourth Annual Report of the Missouri Botanical Garden.—1893.
"Plants of the Bahamas, Jamaica and Grand Cayman,"—Filices,—pp. 151–7.

Hook. and Bak., Syn. Fil., I ed.—Sir W. J. Hooker and J. G. Baker, Synopsis Filicum, 1st edition.—1868.

Hook. and Bak., Syn., Fil.—*Ibid.*, 2nd edition.—1873.

Hook., Cent., Ferns.—Sir W. J. Hooker, A Century of Ferns.—1854.

Hook. et Grev., Icon. Fil.—Sir W. J. Hooker et R. K. Greville, Icones Filicum.—1831.

Hook., Ex. Fl., vol. i.—Sir W. J. Hooker, Exotic Flora, vol. i.—1823.

Hook., Fil. Ex.—Sir W. J. Hooker, Filices Exoticæ.—1859.

Hook., Sp. Fil.—Sir W. J. Hooker, Species Filicum.—Vol. i, 1846; vol. ii, 1858; vol. iii, 1860; vol. iv, 1862; vol. v, 1864.

Johow, An. Univ. Rep. de Chile.—Frederico Johow, Anales de la Universidad, Republica de Chile, vol. lxxxii.—1893.
"Los Helechos de Juan Fernandez," pp. 741–57, and 977–1004.

Kunze, Analec. Pter.—Gustav Kunze, Analecta Pteridographica.—1837.

Kunze, Farrn.—Gustav Kunze, Die Farrnkraüter, vol. i.—1840–7.

Lieb., Mex. Breg.—F. Liebmann, Mexicos Bregner.—1849.

Linn., Syst. Nat., vol. ii.—C. Linné, Systema Naturæ, vol. ii, duodec. ed.—1767.
Filices, pp. 684–96.

Meehan, Nat. Fl. and Ferns of U. S.—Thomas Meehan, The Native Flowers and Ferns of the United States, 1st Series, vol. I.—1878.

Mett., Fil. Hort. Bot. Lip.—G. Mettenius, Filices Horti Botanici Lipsiensis.—1856.

Mett., Üb. Ein. Farn.—G. Mettenius, Über Einige Farngattungen.— Part I, 1856; parts III and IV, 1858; parts V and VI, 1859.

Presl, Hymen.—K. B. Presl, Hymenophyllaceæ.—1843.

Presl, Rel. Haenk.—K. B. Presl, Reliquiæ Haenkeanæ.—1830–36.

Presl, Sup. Tent. Pter.—K. B. Presl, Supplementum Tentaminis Pteridographiæ.—1845.

Presl, Tent. Pter.—K. B. Presl, Tentamen Pteridographiæ.—1836.

Roth., Les Foug.—J. Rothschild, Les Fougéres, vols. I, II.—1867.

Seeman's Bot. Voy. Her.—B. Seemann's Botany of the Voyage of H. M. S. Herald,—1852–7.

Smith, Ferns, Br. and For.—J. Smith, Ferns, British and Foreign.—1876.

Smith, Hist. Fil.—J. Smith, Historia Filicum.—1875.

Swz., Fl. Ind. Occ.—O. Swartz, Flora Indiæ Occidentalis, vol. III.—1806.

Swz., Syn. Fil.—O. Swartz, Synopsis Filicum.—1806.

Underwood, List Pter. and Sperm.—Lucien M. Underwood, in List of Pteridophyta and Spermatophyta.—1893.

Underwood, Our Nat. Ferns and All.—Lucien M. Underwood, Our Native Ferns and Their Allies.—1882.

Williamson, Ferns of Ky.—John Williamson, Ferns of Kentucky.—1878.

INDEX TO SPECIES.

- Acrostichum alienum *Swz.* 187, 207
  - aureum *L.* 188, 207
  - *calomelanos* L. 190
  - canaliculatum (*Kl.*) *Hk.* . . 187
  - caudatum (*Kze.*) *Hk.* . . . 189
  - *citrifolium* L. 189
  - *cylindricum* Kl. 186
  - *fœniculaceum* H. & G. . . 187
  - *hastatum* Lieb. 188
  - *irregulare* Lieb. . . . 188
  - melanopus *Kze.* 189
  - nicotianæfolium *Swz.* . . 188
  - nitidum *Lieb.* 185
  - osmundaceum (*H. B. K.*) *Hk.* . . 119, 186, 207, 212
  - peltatum *Swz.* . . . 187, 207
  - *polypodioides* L. 198
  - scolopendrifolium *Raddi.* 185
  - sorbifolium *L.* 119, 186, 207
  - *tartareum* L. 191
  - tatei *Bak.* 185
  - *umbrosum* Lieb. 188
- Adiantum *acuminatum* Desv. , 148
  - concinnum *H. B. K.* . . 149
  - cristatum *L.* 146
  - *dolabriforme* Hk. . . . 150
  - dolosum *Kze.* 149
  - dolsum var. wilsoni (*Hk.*) *Bak.* 149
  - *fovearum* Rad. 143
  - *intermedium* Swz. 143, 207, 213
  - *kaulfussii* Kze., . 142, 147, 207
  - lucidum *Swz.* 150
  - *lucidum* var. *pinnatum* Fourn. 145
  - lunulatum *Burm.* 150
  - macrophyllum *Swz.* . . 146
  - oblique-truncatum *Fée* . 148
  - *obliquum* H. & G. . 142
  - obliquum *Willd.* 142, 207, 213
  - obliquum var. intermedium (*Swz.*) . . 145, 215
  - *pentadactylon* L. & S. . . 145
  - platyphyllum *Swz.* 147, 207, 213
  - *prionophyllum* H. B. K. . 146
  - pulverulentum *L.* . . 148, 207
  - *seemanni* Hk. . 147, 207, 213
  - *striatum* Willd. 146
  - tenerum *Swz.* . . 149, 208
  - tetraphyllum *Willd.* 146, 208
  - trapeziforme *L.* 145, 208, 215
  - triangulatum *Kaulf.* . . 143
  - *villosum* Eaton. 148
  - villosum *L.* 148
  - *wilsoni* Hk. 149
- Alsophila armata (*Swz.*) *Presl.* 168
  - *hirsuta* Kaulf. 168
  - infesta *Kze.* 168
  - *mexicana* Mart. 168
  - microphylla *Kl.* . . . 169
  - *myosuroides* Lieb. . . . 168
  - phegopteroides *Hk.* . . 168
  - pruinata (*Swz.*) *Kaulf.* . 169
- *Anapeltis lycopodioides* L. . . . 203
- Anemia adiantifolia *Swz.* . . 136
  - breuteliana *Presl.* . . . 136
  - *filiformis* Swz. 136
  - *incisa* Schrad. 136
- *Anetium citrifolium* L. 189
- Antrophyum cayennense *Kaulf.* 193
  - lanceolatum (*L.*) *Kaulf.* . 192
  - lineatum (*Swz.*) *Kaulf.* . 193
  - subsessile *Kze.* 193
- Aspidium *acutum* Presl. . . . 171
  - *chontalense* Fourn. . . . 180
  - *cicutarium* Swz. . . 178, 210

Aspidium *coadunatum* Wall. 178
conterminum Willd. 172, 210
conterminum var. *pilosulum* (Kl.& K.) B.& C. 210, 213
conterminum var. *strigosum* Eaton. 172
cordifolium Swz. 171
coriandrifolium Swz. 178
draconopterum Eaton. 184
effusum Swz. 210
excultum Mett. 175
francoanum Fourn. 176
harrisoni Bak. 210
hippocrepis Swz. 178
karwinskyanum Mett 174
latifolium Presl. 178
levyi Fourn. 180
macrophyllum Swz. 179, 210
meniscioides *Willd.* 181
mexicanum Presl. 173
mexicanum var. *serratum* Mett. 173, 174
molle Jacq. 176, 210
molliculum Kze. 172
nicaraguense (*Fourn.*) *Bak.* 181
parasiticum Swz. 177
patulum Bak. 210
semicordatum (*Swz.*) *Swz.* 180
skinneri Hk. 176
sprengeli Kaulf. 180
trifoliatum (*L.*) *Swz.* 181, 208
Asplenium abscissum *Willd* 165
alatum *H. B. K.* 157
ambiguum Rad. 164
anisophyllum *Kze.* 165
auritum *Swz.* 159, 208
callipteris (*Fée*) *Bak.* 165
caracasanum Mett. 164
celtidifolium *Kze.* 162
cicutarium *L.* 165
crenulatum Presl. 157
cultrifolium *L.* 159, 208
denticulosum Desv. 164
erectum Bory. 158, 208
erectum var. *proliferum* Hk. 158
formosum *Willd.* 160, 208
Asplenium fournieri *Kuhn.* 165
grandifolium *Swz.* 163, 166
heterophyllum Presl. 162
insigne Lieb. 159
kunzei *Mett.* 166
lætum *Swz.* 160
levyi *Fourn.* 166
lindbergii *Mett.* 166
lunulatum Swz. 158, 208
lunulatum var. proliferum (*Swz.*) *Mett.* 158, 208
marginatum *L.* 164
monanthemum *L.* 166
monodon Lieb. 160
mutilum Kze. 163
ottonis Kl. 163
ottonis var. β. 163
plantagineum *L.* 162, 208
pœppigii Presl. 159
proliferum Swz. 158
pterophorum Presl. 157
pumilum *Swz.* 162, 208, 215
radicans *Schk.* 164
resectum Sm. 161
rhizophyllum *Kze.* 165
salicifolium *L.* 166
schkuhrianum Presl. 160
serra *L. & F.* 159, 208
serratum *L.* 157, 208
shepherdi *Spreng.* 164, 208
skinneri (*Moore*) *Bak.* 166
striatum L. 164
subalatum H. & A. 160
sylvaticum *Presl.* 163
tenellum Roxb. 158
Athyrium skinneri Moore. 166
Bathmium nicaraguense Fourn. 181
pœppigii Presl. 179
trifoliatum Link. 181
trifoliatum var. *heracleifolium* Fée. 181
Blechnum *aduncum* Lieb. 156
gracile Kaulf. 156
intermedium Link. 156, 208
longifolium *H. B. K.* 155, 208
longifolium var. fraxineum (*Willd.*) *Bak.* 156
occidentale *L.* 156, 208

Blechnum volubile *Kaulf.* . . . 118, 157, 208
Campteria biaurita L. 136
Campyloneuron coarctatum Kze. . 205
  dimorphum var. *angustifolium* Fourn. 201
  fasciale Presl. 201
  lanciforme Presl. . . . 201
  phyllitidis Presl. 202
Campyloneurum ensifolium Willd. 200
  phyllitidis Presl. 202
  repens L. 202
Ceropteris serrata Fée. . . . 191
Cheilanthes *angustifolia* Hk. . 141
  brachypus Kze. 194
  radiata (*L.*) *Sm.* 141
  squamosa Gill. 194
  squamosa var. *brachypus* Kze. 194
  viscosa *Kaulf.* 141
Chrysodium alienum Mett. . . 188
  aureum Mett. 188
  hirsutum Fée. 188
  nicotianæfolium Mett. . . 188
  vulgare Fée. 188
Chrysopteris sporadocarpa Fée. . 200
Craspedaria cardiophylla Fourn. 204
  cordifolia Fée. 205
  vacinnifolia F. & L. . . 206
Cuspidaria furcata Fée. . . . 196
Cyathea *aculeata* Willd. . . . 166
  arborea (*L.*) *Sw.* . . . 166
  bicrenata Lieb. 168
  grevilleana Mart. . . . 166
  schanschin *Mart.* . . . 167
Cyclodium meniscioides Presl. . 181
Cyclopeltis semicordata Sm. . . 180
Danæa crispa *E. & R.* 206
  elliptica *Sm.* 206
  media Lieb. 206
  moritziana *Presl.* . . . 206
Davallia inequalis *Kze.* 153, 209, 213
  saccoloma *Spreng.* . . 152
Dennstædtia ordinata Fourn. . 155
Dicranoglossum furcata Willd. . 196
Dicksonia adiantoides *H. B. K.* 153
  anthriscifolia Kaulf. . . 154
  cicutaria *Swz.* 155
Dicksonia *dissecta* Hk. . . . 154
  erosa Kze. 153
  obtusifolia Willd. . . . 154
  rubiginosa *Kaulf.* . 154, 209
Dictyoxiphium panamense *Hk.* 150
Didymochlæna lunulata *Desv.* 170
  sinuosa Desv. 170
Didymoglossum krausii Presl. 131, 211
  laceratum Fée. 212
  punctatum Presl 212
  reptans Presl. 212
  sphenoides Presl. . . . 212
    var. *genuina* Fourn. 212
Diplazium plantagineum Swz. . 162
  shepherdi Sm. 164
  striatum Presl. 164
  sylvaticum Swz. 163
Disphenia aculeata Presl. . . . 166
Dryomenis purdiei Sm. . . . 184
Elaphoglossum scolopendrifolium Rad. 185
Gleichenia *immersa* H. & G. . 135
  pubescens (*H. B. K.*) *H. & G.* 135, 209
Goniophlebium adnatum Kze. . 198
  loriceum L. 197
  neriifolium Schk. . . . 198
Goniopteris crenata Presl. . . 183
  megalodes Presl. . . . 183
  tetragona Swz. 183
Gymnogramma calomelanos (*L.*) *Kaulf.* 190, 209
    var. tartarea (*L.*) *B. & Ch.* 191
  flexuosa (*H. B. K.*) *Desv.* 192, 209
  incisa *M. & L.* 191
  lindigii *Mett.* 192
  peruviana Desv. . . . 191
  pumila *Spreng.* 190
  rufa (*L.*) *Desv.* 192
  tartarea Desv. . . 120, 191
    var. *ornithopteris* (Kl.) Bak. 191
Gymnogramme palmata Link. . 190
Gymnopteris aliena Swz. . . . 188
  irregularis Fourn. . . . 188
Haplopteris lineata Sm. . . . 195

Hecistopteris pumila Sm. 190
Hemidictyum marginatum Presl. 165
Hemiphlebium pusillum Swz. 212
Hemionitis citrifolia (*L.*) *Hk.* 189
  lanceolata L. 192
  levyi *Fourn.* 190
  palmata *L.* 189, 209
  parasitica L. 189
Hemitelia grandifolia (*Willd.*) *Spreng.* 167, 209
  nigricans *Presl,* 167
Hymenophyllum ciliatum *Swz.* 128, 209
  fucoides *Swz.* 128
  jalapense Schl. 127
  polyanthos *Swz.* 127, 209
  protrusum Hk. 127
  valvatum, *H. & G.* 128
Hymenostachys elegans Rudge. 211
Hypoderris *adnata* Fourn. 169
  marginalis Fourn. 169
  seemanni *Prent.* 169
Hypolepis hostilis *Presl.* 142
  purdieana *Hk.* 142
  repens (*L.*) *Presl.* 142, 209
Lastrea athyrioides Lieb. 174
  contermina Willd. 172
  mexicana Hk. 173
  mexicana Lieb. 174
  semicordatam Presl. 180
Lecanium membranaceum Presl. 212, 213
Lepicystis incana Swz. 199
Leptocyonium pedicellatum Kze. 128
Lindsæa panamensis Mett. 150
Lindsaya horizontalis *Hk.* 151, 152
  leprieurii Hk. 151
  trapeziformis *Dry.* 151, 152, 209
Litobrochia biaurita Sm. 211
  elata Sm. 211
Lomaria onocleoides *Spreng.* 155
Lomariopsis longifolia Sm. 186
  sorbifolia Fée. 186
  vestita Fourn. 186
  wrightii Mett. 186
Lonchitis hirsuta L. 139, 211
  repens L. 142
Lopholepis ciliata Willd. 197
Lophosoria pruinata Presl. 169
Loxogramme lanceolata Presl. 192
Lygodium commutatum *Presl.* 135
  heterodoxum *Kze.* 135
  oligostachyum *Desv.* 136
  spectabile Lieb. 135
  venustum *Swz.* 135, 210, 215
Marginaria incana Presl. 199
  piloselloides Presl. 197
Marattia alata *Sm.* 206
  weinmanniæfolia Lieb. 206
Meniscium reticulatum (*L.*) *Swz.* 193
Mertensia farinosa Kaulf. 135
  tomentosa Swz. 135
Microlepia inequalis Presl. 153
Monogramme immersa (*Fée*) *Hk.* 194
  rostrata *Hk.* 195
Nephrodium chontalense (*Fourn.*) *Hemsl.* 180
  cicutarium (*L.*) *Bak.* 178, 210, 214
  conterminum (*Willd.*) *Desv.* 120, 172, 210, 213, 214
  effusum (*Swz.*) *Bak.* 175, 210
  endresi *Bak.* 177
  excultum Hk. 175
  falciculatum *Desv.* 180
  harrisoni Bak. 176
  hippocrepis Presl. 178
  karwinskyanum (*Mett.*) *Bak.* 174
  levyi (*Fourn.*) *Bak.* 180
  macrophyllum (*Swz.*) *Bak.* 179, 210
  mexicanum *Presl.* 173, 210
  molle Desv. 177
  panamense Presl. 172
  parasiticum (*L.*) 177, 210
  patens (*Swz.*) *Desv.* 180
  patulum *Bak.* 173
  semicordatum Presl. 180
  skinneri *Hk.* 176, 210
  sphærocarpum (*Fée*) *Hk.* 174
    var. *glandulosum* Hk. 174
  sprengeli (*Kaulf.*) *Hk.* 180
  stenophyllum Bak. 176

Nephrodium triste (*Kze.*) *Hk.* . . 180
  villosum (*Swz.*) *Presl.* . . 180
Nephrolepis *acuminata* Presl. . . 171
  acuta (*Schk.*) *Presl.* . . 171, 210
    var. subferruginea *Hk.* . . 171
  cordifolia (*L.*) *Presl.* . . 171, 210
  pendula Fée. . . 171
  punctulata Presl. . . 171
  rufescens *Presl.* . . 172
  tuberosa Presl. . . 171
Neurogramme rufa Fourn. . . 192
Neuromanes hedwigii V. den B. 134
Neurophyllum pinnatum Presl. . 212
Nothochlæna brachypus Kze. . . 194
  squarrosa Fée. . . 194
Notholæna brachypus (*Kze.*) *Sm.* . . 120, 194
Oleandra nodosa *Presl.* . . 170, 210
Olfersia peltata Presl. . . 187
Onoclea sorbifolium Swz. . . 186
Pellæa angustifolia (*H. B.* K.) *Bak.* . . 141
Phegopteris *androgyna* (Poir.) 184
    var. *megaloda*(Schk.) 184
  crenata (*Swz.*) *Mett.* . . 183, 210
  decussata (*L.*) *Mett.* . . 182, 210
  divergens Fée. . . 175
  draconoptera (*Eaton*) *Shim.* . . 184, 215
  effusa Swz. . . 175
  martinicensis *Fourn.* . . 185
  megalodus Mett. . . 183
  nicaraguensis *Fourn.* . . 185
  punctata (*Thunb.*) *Mett.* . . 182, 210, 212
  rugulosa Fée. . . 182
  tetragona (*Swz.*) *Mett.* 183, 211
    var. megaloda (*Schk.*) . . 184
  wagneri Mett. . . 196
Phlebodium areolatum Willd. . 200
Phymatodes crassifolia Presl. . 204
  lycopodioides L. . . 203
  percussa Cav. . . 203
Pleopeltis aurea Presl. . . 200
  lycopodioides Presl. . . 203
  percussa Presl. . . 203
  squamulosa Presl. . . 203
Pleuridium crassifolium L. . . 204
Polybotrya canaliculata Kl. . . 187
  osmundacea H. B. K. . . 186
Polypodium adnatum (*Kze.*)*Hk.* 198
  androgynum Poir. . . 183
  angustifolium *Swz.* . . 200
    var. ensifolium (*Willd.*) *Bak.* . . 200
  anisomeron Fée. . . 205
  appendiculatum Swz. . . 178
  arboreum L. . . 166
  areolatum H. B. K. . . 200
  attenuatum *H. B. K.* . . 204
  aureum *L.* . . 200
    var. areolatum (*H. B. K.*) *Bak.* . . 200
  cæspitosum Link. . . 202
  cardiophyllum *Presl.* . . 204
  chnoodes *Spreng.* . . 205
  cicutarium L. . . 178
  ciliatum Willd. . . 197
  coarctatum *Kze.* . . 205
  consimile Mett. . . 196
  cordatum Desv. . . 205
  cordifolium Swz. . . 171
  crassifolium *L.* . . 204
  crenatum Swz. . . 183, 210
  cultratum *Willd.* . . 205
  cuspidatum Presl. . . 203
  decussatum L. . . 182, 210
  dilatum Lieb. . . 175
  divergens Swz. . . 175
  draconopterum Hk. . . 184
  effusum Swz. . . 175
  elasticum Bory. . . 205
  elasticum *Rich.* . . 205
  ensifolium Willd. . . 200
  falcaria Kze. . . 197
  fasciale Willd. . . 201
  friedrichsthalianum *Kze.* 205
  gonatodes Kze. . . 197
  incanum Swz. . . 120, 198
  kuhnii *Fourn.* . . 205
  lætum Rad. . . 197
  lævigatum *Cav.* . . 201
  lanceolatum *L.* . . 205
  lapathifolium Swz. . . 201
  lepidopteris *Kze.* . . 200
  loriceum *L.* . . 197
  lycopodioides *L.* . . 203
    var. salicifolium *Willd.* . . 204
  macbridense *Shim.* . . 199
  megalodus Schk. . . 183
  neriifolium *Schk.* . . 198

- Polypodium *otites* L. 196
  - *paradiseæ* L. & F. . . . 196
  - *parasiticum* L. 176
  - pectinatum *L.* 196
  - percussum *Cav.* . . . 203
  - phyllitidis *L.* 202
  - piloselloides var. ciliatum (*Willd.*) *Bak.* 197
  - plesiosorum *Kze.* . . . 205
  - *plumula* Willd. 205
  - polypodioides (*L.*) *Hitch.* 198
  - pruinatum *Bak.* 205
  - puberulum *Ch. & Schl.* . 205
  - *punctatum* Thunb. . 182, 210
  - repens *L.* 201
  - *repens* Mett. 202
  - *reticulatum* L. 193
  - *rhodopleurum* Fée. . . . 205
  - *rugulosum* Lab. 182
  - *semicordatum* Swz. . . . 180
  - serrulatum *Mett.* . . . 205
  - sororium *H. B. K.* . . . 196
  - *sporadocarpum* Willd. . . 200
  - *stigmaticum* Presl. . . . 203
  - *tæniosum* H. B. K. . . . 201
  - *tetragonum* Swz. . 183, 211
    - var. *megalodum* (Schk.) Bak. . . 183, 211
  - trichomanoides *Swz.* . . 205
  - *trifoliatum* L. 181
  - truncicola *Kl.* 206
  - vaccinifolium *F. & L.* . 206
- Pteris aculeata *Swz.* . . 139, 211
  - *angustifolia* Swz. . . . 195
  - *apicalis* Lieb. 139
  - aquilina *L.* 141
    - var. caudata (*L.*) *Hk.* 141
    - var. lanuginosa (*Bory.*) *Hk.* 141
  - *aurita* Bl. 140
  - biaurita *L.* . . . 136, 211
  - *caudata* L. 141
  - *decomposita* Gaud. . . . 141
  - *edentula*, Kze. 136
  - elata *Ag.* 141, 211
  - *furcata* L. 196
  - *galeotti* Fée. 136
  - hirsuta (*L.*) *Hk.* . . 139, 211
  - incisa *Thunb.* . . . 140, 211
  - *laciniata* Willd. . . 139, 211
  - *lineata* L. 195
  - *luschnathiana* Bak. . . . 140
  - *nemoralis* Willd. . . 136, 211
- Pteris *podophylla* Swz. 139
  - *propinqua* Ag. 139
  - pungens *Willd.* 141
  - *quadriaurita* Retz. . 136, 211
    - var. *biaurita* (*L.*) *B. & Ch.* 211
- *Pteropsis angustifolia* Desv. . . 195
- *Rhipidopteris peltata* Swz. . . 187
- *Saccoloma elegans* Kaulf. . . . 152
- *Sagenia cicutaria* Presl. . . . 178
  - *coadunata* Moore. . . . 178
- *Salpichlæna volubile* Sm. . . . 157
- *Sitolobium adiantoides* Sm. . . 153
  - *rubiginosa* Sm. 154
- Tænitis angustifolia *R. Br.* . . 195
  - furcata (*L.*) *Willd.* . . 195
- Trichomanes alatum *Swz.* . . 134
  - *anceps* Hk. 134
  - *ankersii* Parker. 132
  - brachypus *Kze.* 132, 211, 212
  - *cavifolium* C. Mill. . . . 132
  - crispum *L.* . . . 133, 211
  - daucoides *Presl.* . . . 134
  - elegans *Rudge.* . . 129, 211
  - *floribundum* H. B. K. . . 134
  - *hookeri* V. den B. . . . 212
  - *incisum* Kaulf. 131
  - krausii *H. & G.* . . 131, 211
  - *kunzeanum* Hk. 133
  - *leprieurii* Kze. 212
  - membranaceum *L.* 129, 211, 213
  - *mexicanum* V. den B. . . 133
  - *olivaceum* Kze. 132
  - pinnatum *Hedw.* . 134, 212
  - prieurii *Kze.* . . . 134, 212
  - punctatum *Poir.* . 129, 212
  - pusillum *Swz.* . . 130, 212
    - var. quercifolium (*H. & G.*) *Bak.* . . . 130
  - pyxidiferum *L.* . . 132, 212
  - *quercifolium* H. & G. . . 130
  - *radicans* H. & G. . . . 132
  - radicans *Swz.* . . . 132, 212
  - *reptans* Swz. . . . 129, 212
  - *scandens* L. 133
  - scandens L. 134
  - *sphenoides* Kze. . . 130, 212
  - trichoideum *Swz.* . . . 135
- Vittaria *costata* Kze. 195
  - gardneriana *Fée.* . . . 195
  - lineata (*L.*) *Swz.* . . . 195
- *Xiphopteris serrulata* Kaulf. . . 205

EXPLANATION OF PLATE I.

Hymenophyllum polyanthos Swz. p. 127.

Fig. 1. A sterile frond, with rootstock. × 1.

Trichomanes membranaceum L. p. 129.

Fig. 2. A sterile frond, showing marginal scales. × 1.

Fig. 3. A lobed fertile frond. × 1.

Trichomanes punctatum Poir. p. 129.

Figs. 4–7. Fertile fronds, showing variation in division and in the length of the stipe. × 1.

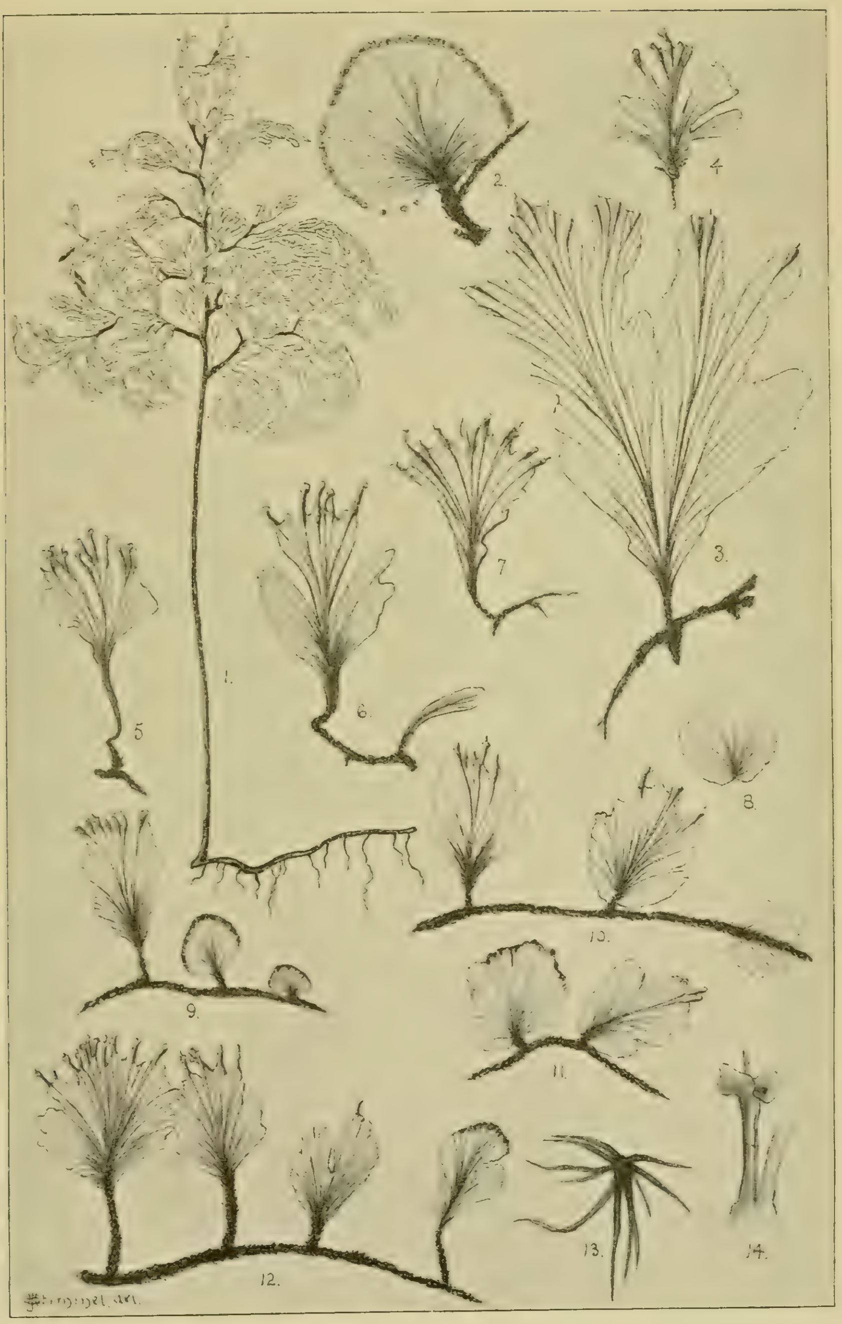
Fig. 8. A sessile sterile frond. The marginal hairs are not shown. × 1.

Figs. 9–12. Pieces of rootstocks with fronds, showing variation in form, size and division of the fronds, and in the length of the stipes. × 1.

Fig. 13. A stellate marginal hair. Magnified.

Fig. 14. A single involucre. Magnified.

PLATE I.


1.
2.
3.
4
5
6.
7
8.
9.
10.
11.
12.
13.
14.

EXPLANATION OF PLATE II.

Trichomanes pusillum var. *quercifolium* (H. et G.) Bak. p. 130.

Fig. 1. A fertile frond. × 1.

Trichomanes brachypus Kunze. p. 132.

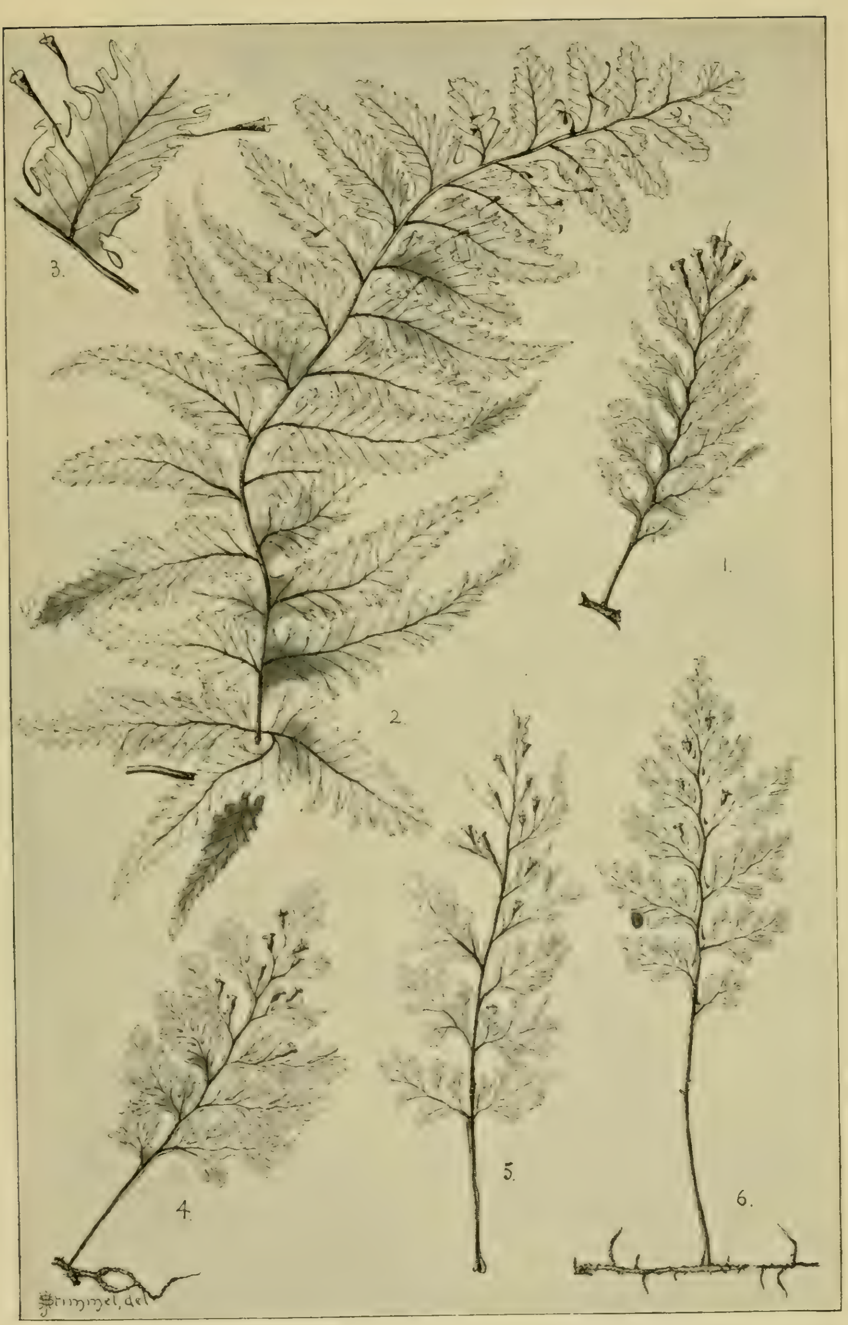
Fig. 2. A fertile frond with piece of rootstock which is partly hidden by the lobe of the basal pinna. × 1.

Fig. 3 A fragment of a pinna. × 2.

Trichomanes pyxidiferum L. p. 132.

Figs. 4–6. Fertile fronds, showing variation in form and division.

PLATE II.


3.
2.
1.
4.
5.
6.
Strimmel, del

EXPLANATION OF PLATE III.

Trichomanes radicans Swz. p. 132.

Fig. 1. A frond with fragment of rootstock. × ⅓.

Fig. 2. A fertile pinna. × 1.

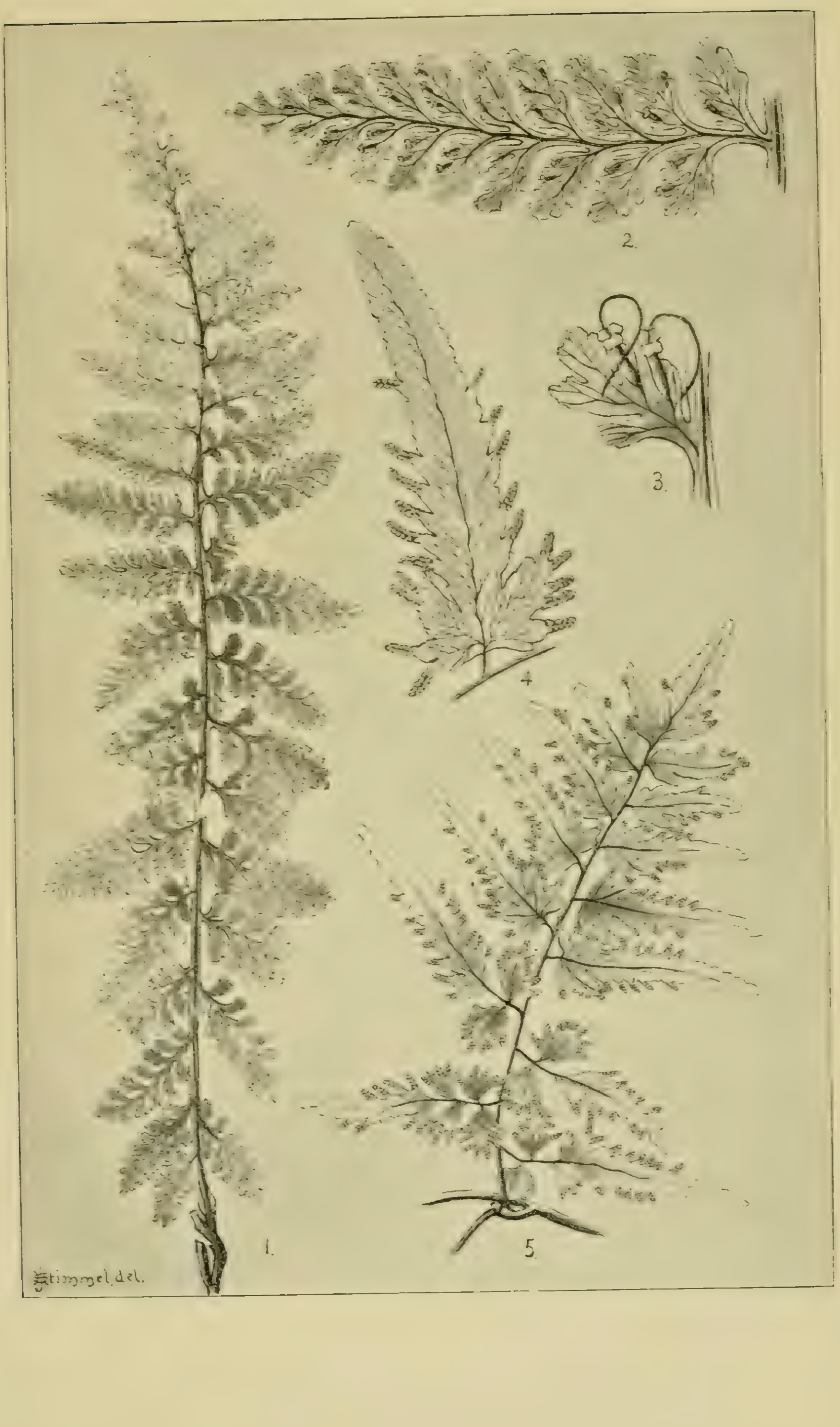
Fig. 3. A small fertile pinnule with two sori. Magnified.

Lygodium venustum Swz. p. 135.

Fig 4. A fertile segment. × 1.

Fig. 5. A fertile pinnule (one of the pair constituting a pinna), showing the dichotomous division of the stalk of the pinna. × ½.

PLATE III.


2.
3.
4
5.
1.
Stimmel del.

EXPLANATION OF PLATE IV.

Pteris biaurita L. p. 136.

Fig. 1. Three pinnules (or lobes), showing venation of typical *biaurita.* × 2.

Fig. 2. Two pinnules (or lobes) of the form *quadriaurita* showing a vein springing directly from the midrib of the pinna. × 2.

Fig. 3. Two pinnules from the same frond as fig. 2, showing typical venation of *quadriaurita.* × 2.

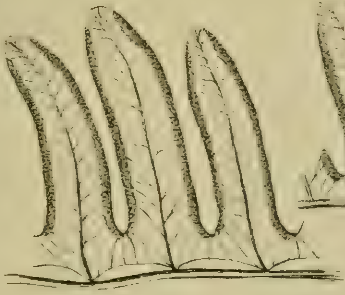
Fig. 4. A portion of a pinna of the pentagonal form, showing the venation of *nemoralis.* × 2.

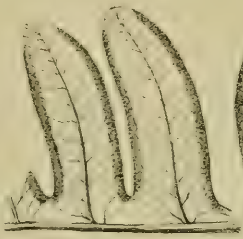
Fig. 5. A part of a pinna of nearly typical *quadriaurita*, showing a broad base. × 1.

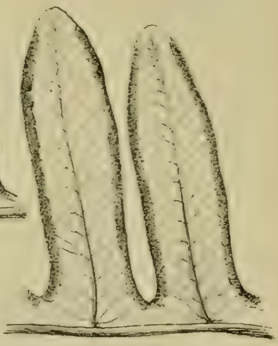
Fig. 6. A part of a pinna of the pentagonal (*nemoralis*) form, showing a tapering base. × 1.

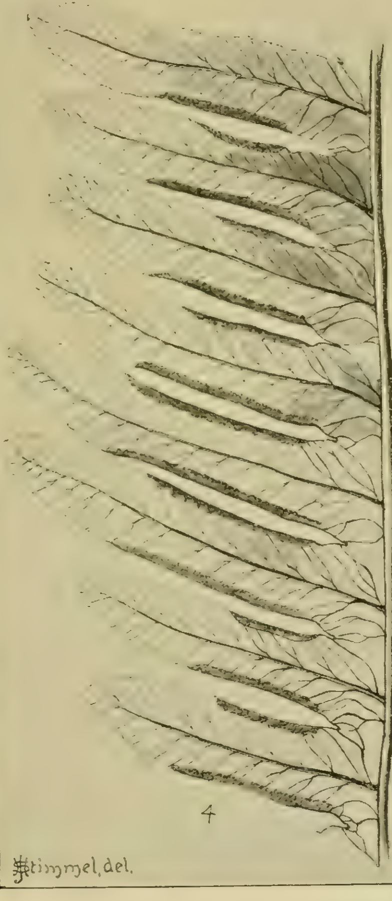
Figs. 1, 2, 3, and 5 represent specimens from Ometépe, and figs. 4 and 6 from Castillo.

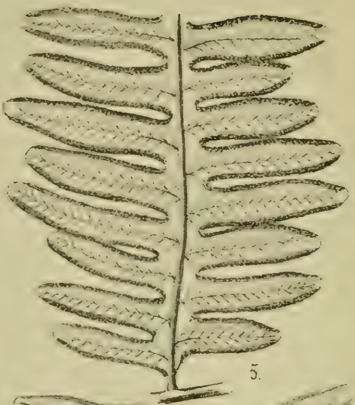
PLATE IV.

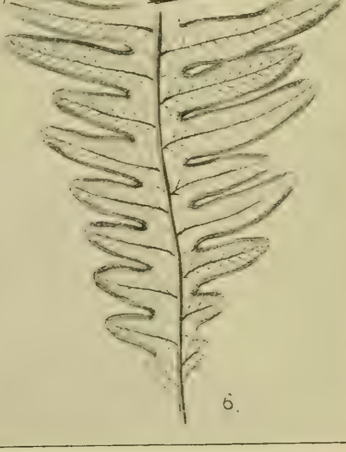

1


2.


3.


4


5.


6.

Stimmel, del.

EXPLANATION OF PLATE V.

Pteris incisa Thunb. p. 140.

Fig. 1. The second pinnule from the base of a pinna, showing venation. × 1.

Fig. 2. A basal pinnule. × 1.

Hypolepis hostilis Presl. p. 142.

Fig. 3. A fertile pinnule. × 2.

Hypolepis repens (L.) Presl. p. 142.

Fig. 4. A fertile pinnule. A little more than × 2.

Adiantum obliquum Willd. p. 142.

Fig. 5 The second pinna from the base of a once-pinnate frond (*kaulfussii*). × 1.

Fig. 6. The basal pinna of *kaulfussii* showing the beginning of division. × 1.

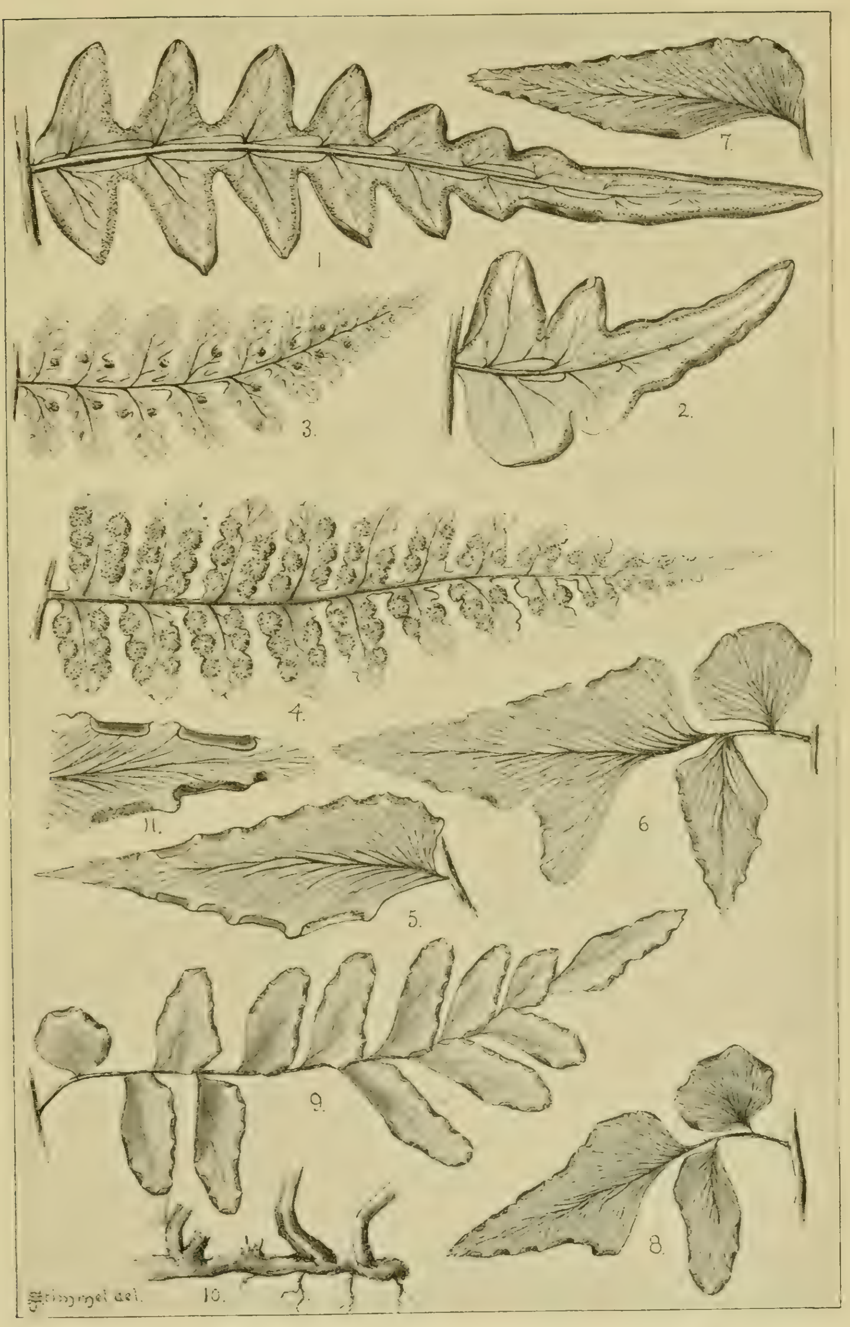
Figs. 7–9. Pinnæ from one frond showing an approach to the form *intermedium*. Figs. 8 and 9 represent the two basal pinnæ. The remaining pinnæ of this fond are undivided. × 1.

Fig. 10. A piece of rootstock of the form *intermedium*, with bases of fronds. × 1.

Fig. 11. The obtuse tip of a pinna from the same frond as fig. 5. × 1.

Figs. 5–11 represent specimens from the La Juana River.

PLATE V.


1
7.
3.
2.
4.
11.
6
5.
9.
8.
10.
Stimmel del.

EXPLANATION OF PLATE VI.

Adiantum obliquum Willd. p. 142.

Figs. 1, 2. Basal pinnæ of *kaulfussi*. × 1.

Fig. 3. Basal pinna of the glaucous form of *intermedium*. × 1.

Fig. 4. Basal pinna of typical *obliquum*. × 1.

Fig. 5. Basal pinna of the *var. β*. × 1.

Fig. 8. Part of rootstock of typical form. × 1.

Figs. 1 to 4, and 8 represent specimens from Castillo, and fig. 5 from Camp Menocal.

Adiantum trapeziforme L. p. 145.

Fig. 6. A middle pinnule. × 1.

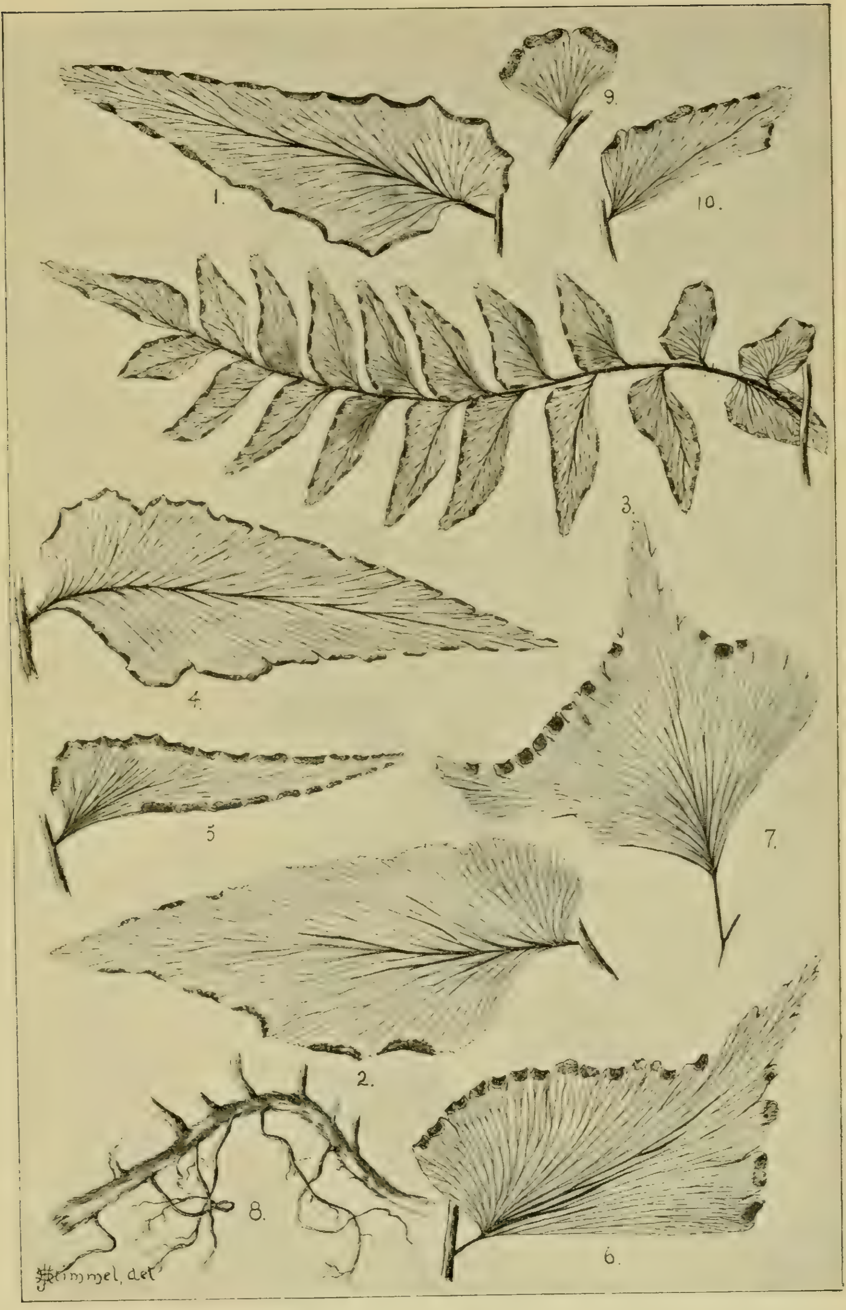
Fig. 7. A terminal pinnule. × 1.

Adiantum tetraphyllum Willd. p. 146.

Fig. 9. Basal pinnule. × 1.

Fig. 10. Middle pinnule. × 1.

PLATE VI.


1.
9.
10.
3.
4.
5
7.
2.
8.
6.
Himmel, del.

EXPLANATION OF PLATE VII.

Adiantum obliquum Willd. p. 142.

Figs. 1–4. Successive stages between *kaulfussi* and *intermedium.* × ½.

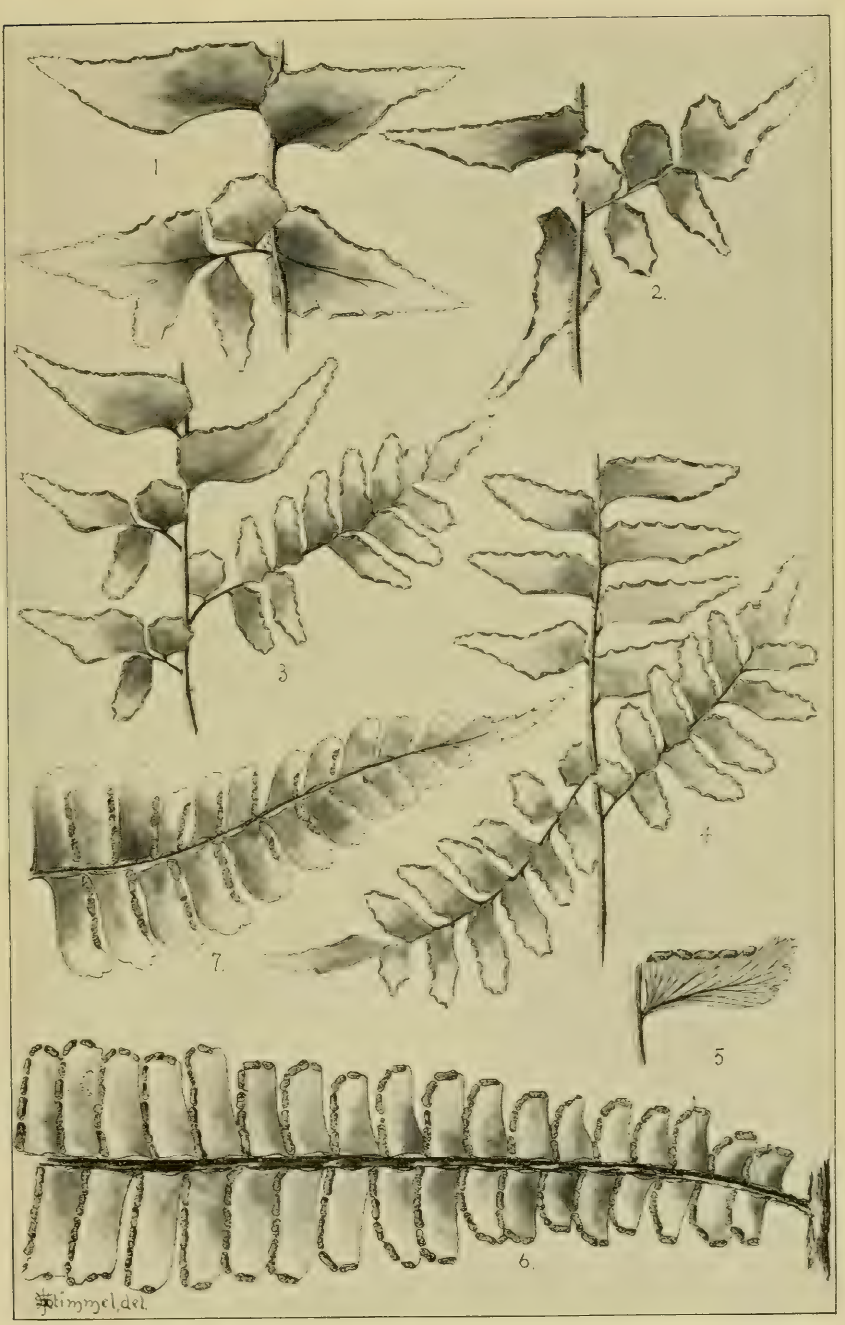
Adiantum cristatum L. p. 146.

Fig. 5. A middle pinnule. × 1.

Fig. 6. Basal half of a pinna. × 1.

Fig. 7. The tip of a pinna. × 1.

PLATE VII.


1
2.
3
4
5
6.
7.
Stimmel, del.

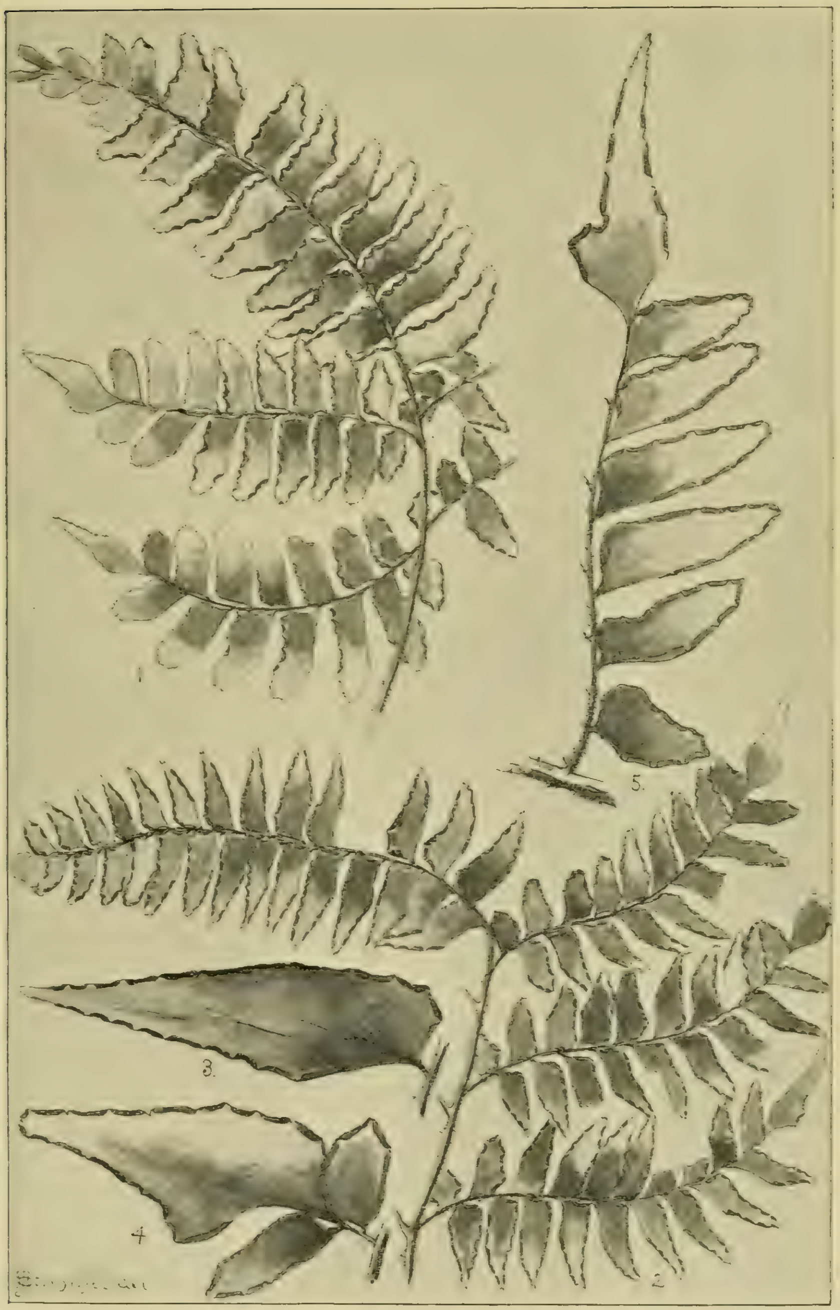
EXPLANATION OF PLATE VIII.

Adiantum obliquum Willd. p. 142.

Figs. 1, 2. Fronds of *intermedium*, forming a continuation of the series on Pl. VII. × ½.

Figs. 3–5. Pinnæ of *triangulatum* near typical *obliquum*. Fig. 5 represents a basal pinna, fig. 4 the next one above it, and fig. 3 one of the upper pinnæ. × 1.

PLATE VIII.



EXPLANATION OF PLATE IX.

Adiantum macrophyllum Swz. p. 146.

Fig. 1. A divided basal pinna. × 1.

Fig. 2. A forked basal pinna from the same frond. × 1.

Fig. 3. A simple pinna from the same frond. × 1.

Adiantum platyphyllum Swz. p. 147.

Fig. 4. A fertile pinna, the second from the base. × 1.

Fig. 5. A basal pinna from a younger frond. × 1.

Adiantum villosum L. p. 148.

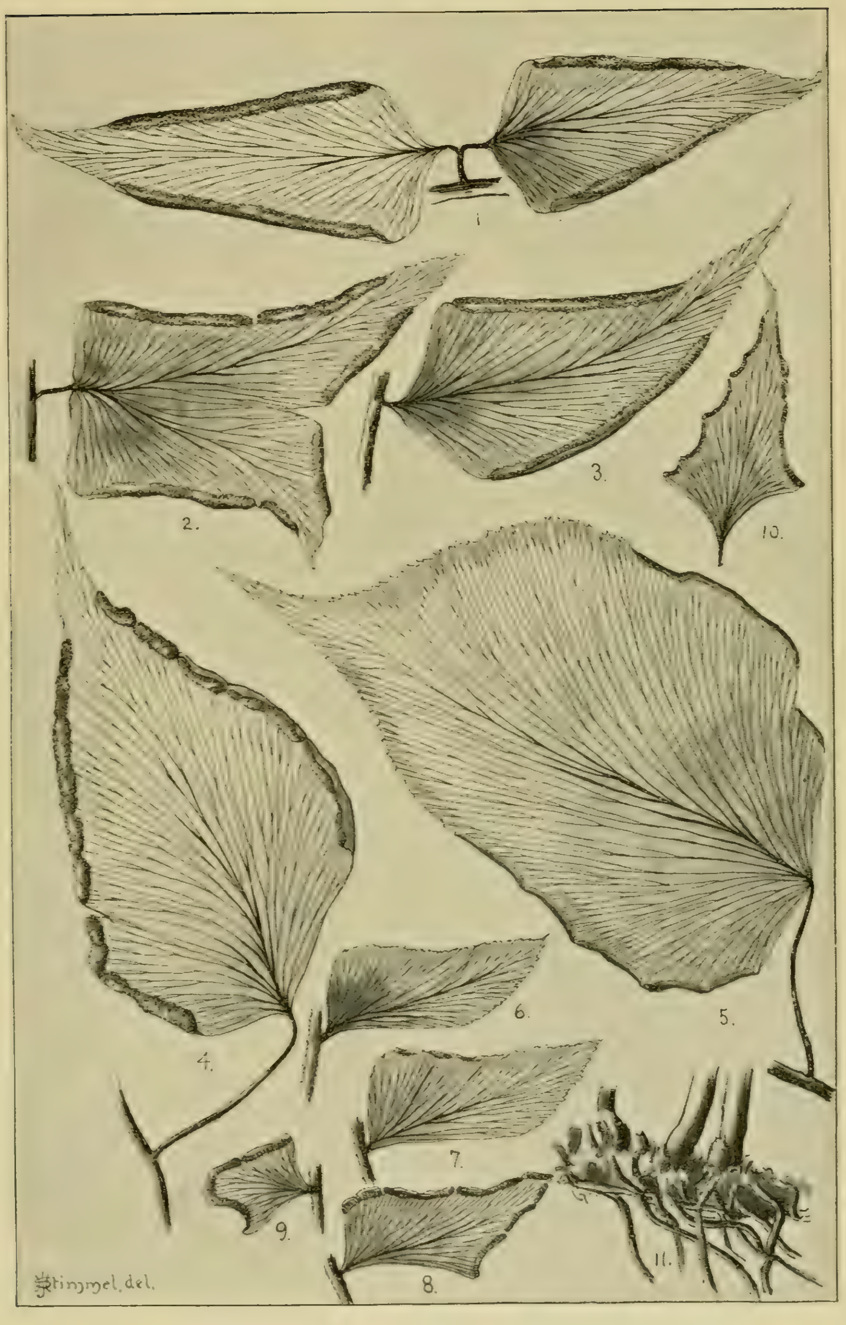
Figs. 6–8. Middle pinnules. × 1.

Fig. 9. A basal pinnule. × 1.

Fig 10. A terminal pinnule. × 1.

Fig. 11. A part of rootstock. × 1.

PLATE IX.


1
2.
3.
10.
4.
5.
6.
7.
9.
8.
11.
Stimmel. del.

EXPLANATION OF PLATE X.

Adiantum pulverulentum L. p. 148.

Fig. 1. The basal half of a pinna. × 1.

Adiantum concinnum H. B. K. p. 149.

Figs. 2–7. Segments of various sizes and forms. × 1.

Adiantum tenerum Swz. p. 149.

Figs. 8, 9. Fertile segments. × 1.

Fig. 10. A sterile segment. × 1.

Adiantum dolosum var. *wilsoni* (Hook.) Bak. p. 149.

Fig. 11. A fertile pinna. × 1.

Fig. 12. A young, sterile, simple frond. × $\frac{3}{5}$.

Dictyoxiphium panamense Hook. p. 150.

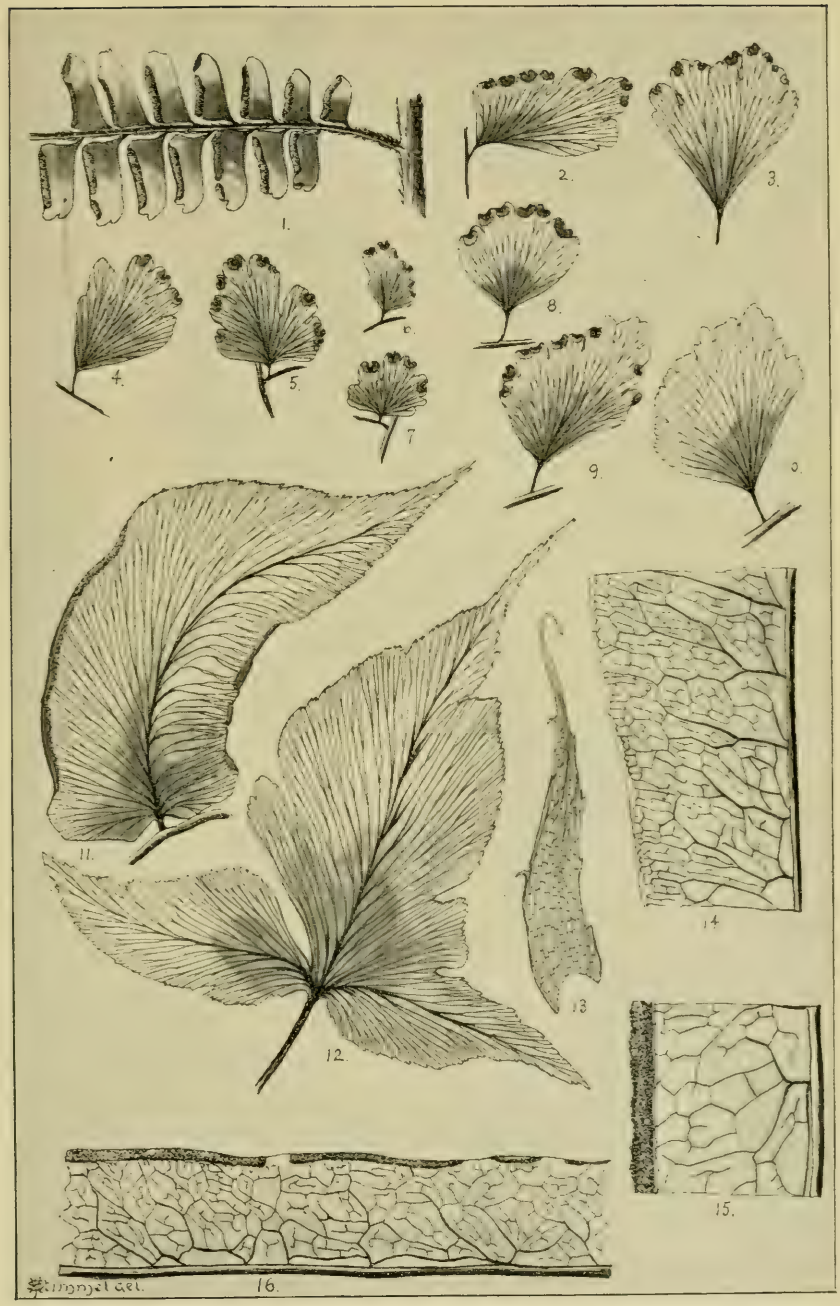
Fig. 13. A scale from the stipe. Magnified.

Fig. 14. A part of sterile frond, showing venation. × 1.

Fig. 15. A part of fertile frond, showing venation, fruit, and the inner involucre. Magnified.

Fig. 16. A part of fertile frond, showing interrupted sori. × 1.

PLATE X.


1.
2.
3.
4.
5.
6.
7
8.
9.
10.
11.
12.
13
14
15.
16.
E. Timmjel del.

EXPLANATION OF PLATE XI.

Lindsaya trapeziformis Dry. p. 151.

Fig. 1. The smaller part of a forked frond. (Rather like a large compound pinna). × 1.

Fig. 2. Basal pinna of once-pinnate frond. × 1.

Fig. 3. Middle pinna of same frond. × 1.

Fig. 4. The basal pinna which is opposite the compound part (pinna) in fig. 1. × 1.

Fig. 5. A basal pinnule from compound frond. × 1.

Figs. 6, 7. Tips of compound pinnæ from same frond. × 1.

Lindsaya horizontalis Hook. p. 152.

Fig. 8. A pinna. × 1.

Fig. 9. Tip of pinna. × 1.

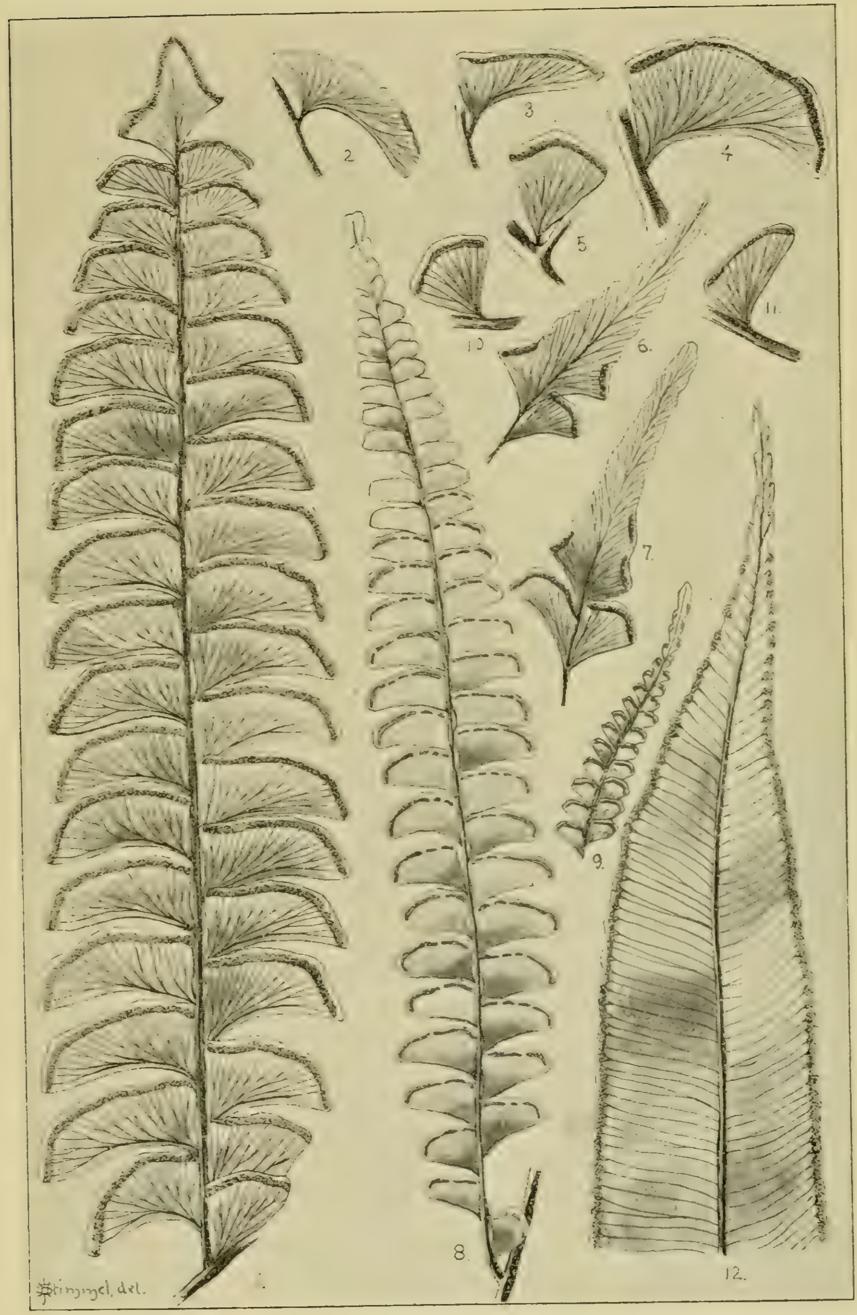
Fig. 10. Basal pinnule. × 1.

Fig. 11. Middle pinnule. × 1.

Davallia saccoloma Spreng. p. 152.

Fig 12. Tip of pinna. × 1.

PLATE XI.


1
2
3
4
5
10
11
6
7
9
8
12
Stimmel, del.

EXPLANATION OF PLATE XII.

Davallia saccoloma Spreng. p. 152.

Figs. 1–3. Bases of pinnæ, showing variation in form and division. × 1.

Fig. 4. Part of pinna. Magnified.

Davallia inequalis Kze. p. 153.

Fig. 5. Tip of pinna. × 1.

Fig. 6. A pinnule. × 1.

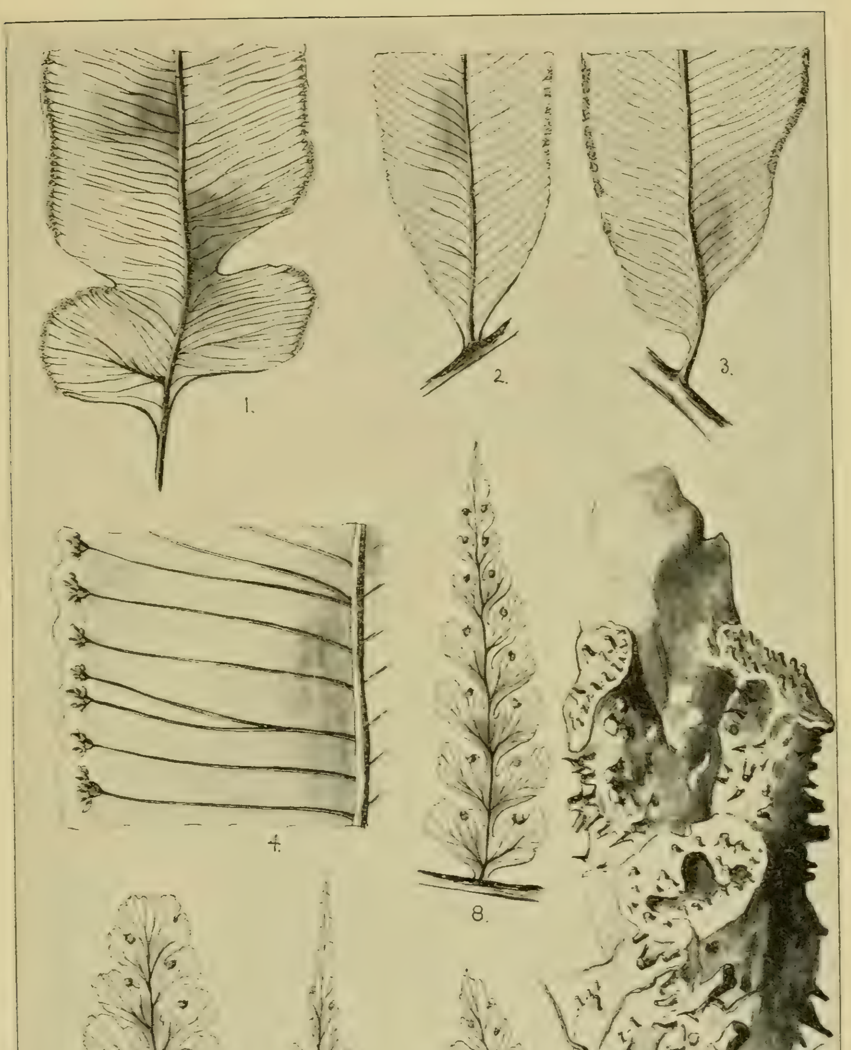
Dicksonia adiantoides H. B. K. p. 153.

Figs. 7, 8. Pinnules from the same frond showing variation in apex. × 1.

Dicksonia rubiginosa Kaulf. p. 154.

Fig. 9. Upper part of rootstock, showing leaf-scars, roots and spines. × 1.

PLATE XII.


1.
2.
3.
4.
8.
7.
5
6.
9.
Grimmel, del.

EXPLANATION OF PLATE XIII.

Dicksonia rubiginosa Kaulf. p. 154.

Fig. 1. A basal pinnule, with part of main rachis. × 1.

Fig. 2. A division of a segment. Magnified.

Blechnum longifolium H. B. K. p. 155.

Fig. 3. A fertile frond. × 1.

Fig. 4. A pinna, showing venation under sorus. × 2.

Asplenium alatum H. B. K. p. 157.

Fig. 5. A pinna. × 1.

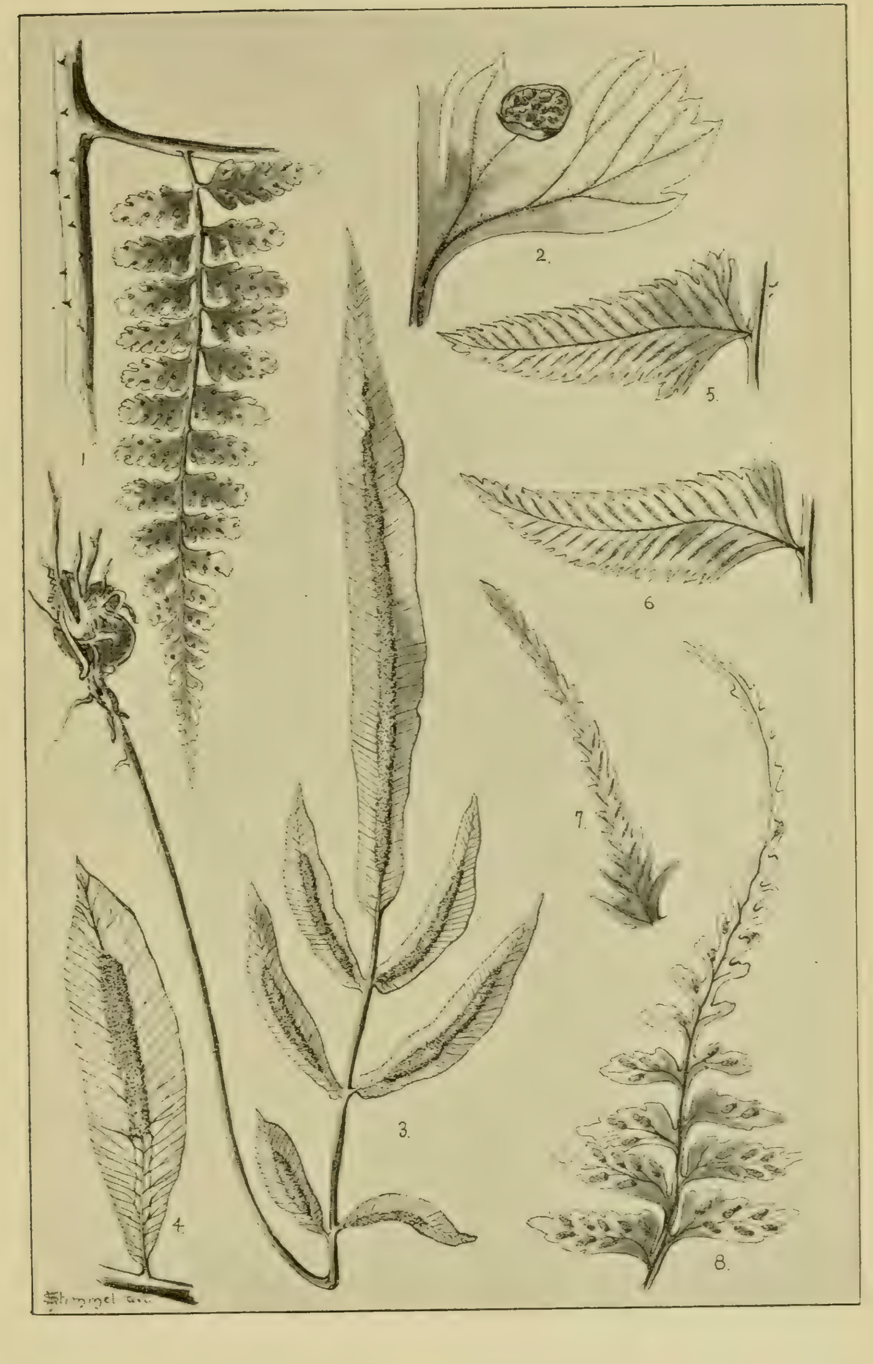
Fig. 6. A pinna. × 1.

Fig. 7. Tip of the same frond as fig. 6. × 1.

Asplenium lunulatum var. *proliferum* (Swz.) Mett. p. 158.

Fig. 8. Tip of a frond. × 1.

PLATE XIII.


1
2.
3.
4.
5.
6
7.
8.
Shimmel del.

EXPLANATION OF PLATE XIV.

Asplenum lunulatum var. *proliferum* (Swz.) Mett. p. 158.

Fig. 1. One side of basal half of frond. × 1.

Asplenium cultrifolium L. p. 159

Figs. 2–4. Pinnæ, showing variation in form and margin. × 1.

Asplenium serra L. et F. p. 159.

Figs. 5, 6. Pinnæ from the same frond, showing variation in base. × 1.

Asplenium auritum Swz. p. 159.

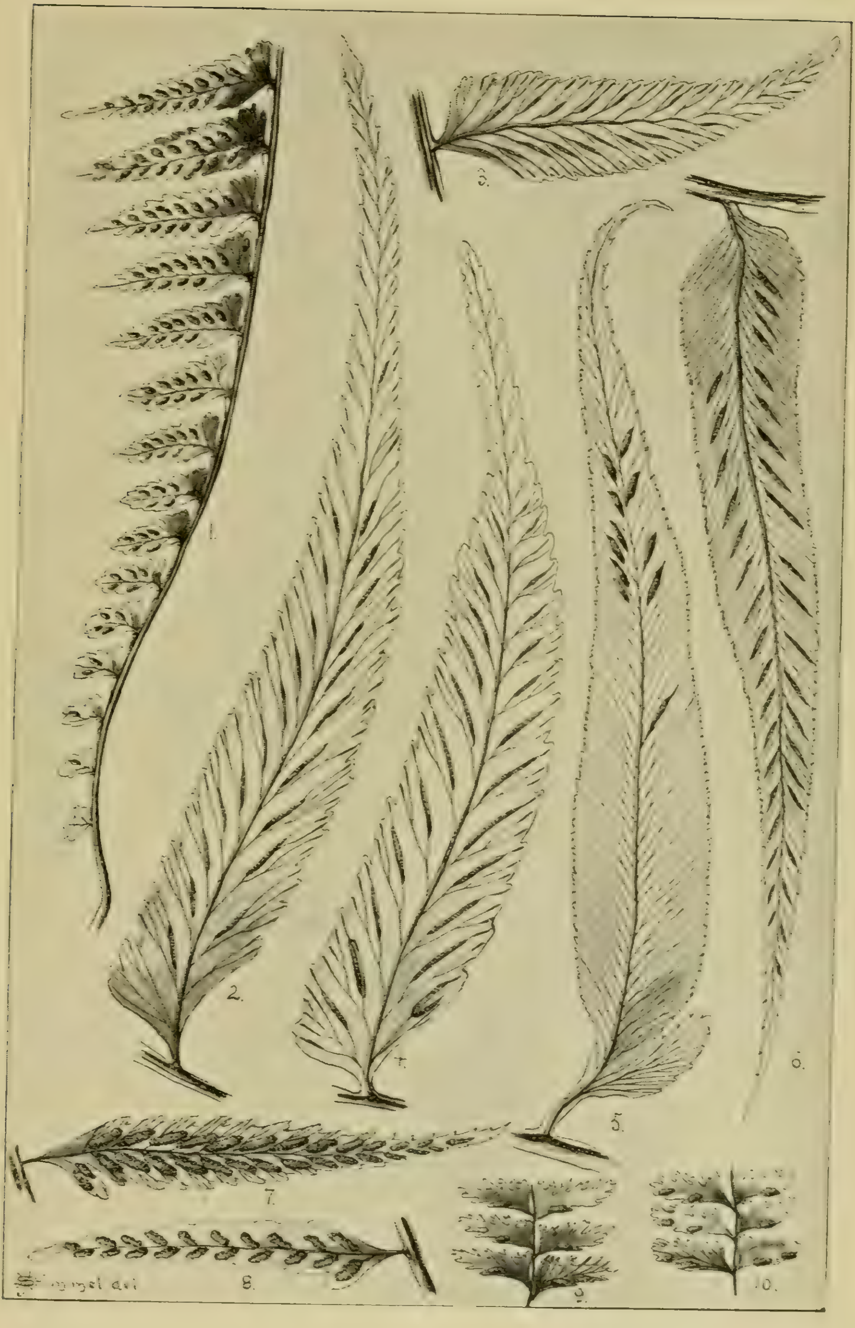
Figs. 7, 8. Pinnæ, showing variation in form and margin. Both figures are inverted. × 1.

Asplenium formosum Willd. p. 160.

Fig. 9. A part of a frond from Ometépe. × 1.

Fig. 10. A part of a frond from the Los Sabalos River. × 1.

PLATE XIV.


1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
del.

EXPLANATION OF PLATE XV.

Asplenium lætum Swz. p. 160.

Fig. 1. Basal part of frond, showing lobed pinnæ. × 1.

Fig. 2. A pinna. × 1.

Figs. 3, 4. Pinnæ from one frond. × 1.

Fig. 5. Pinnæ from small frond. × 1.

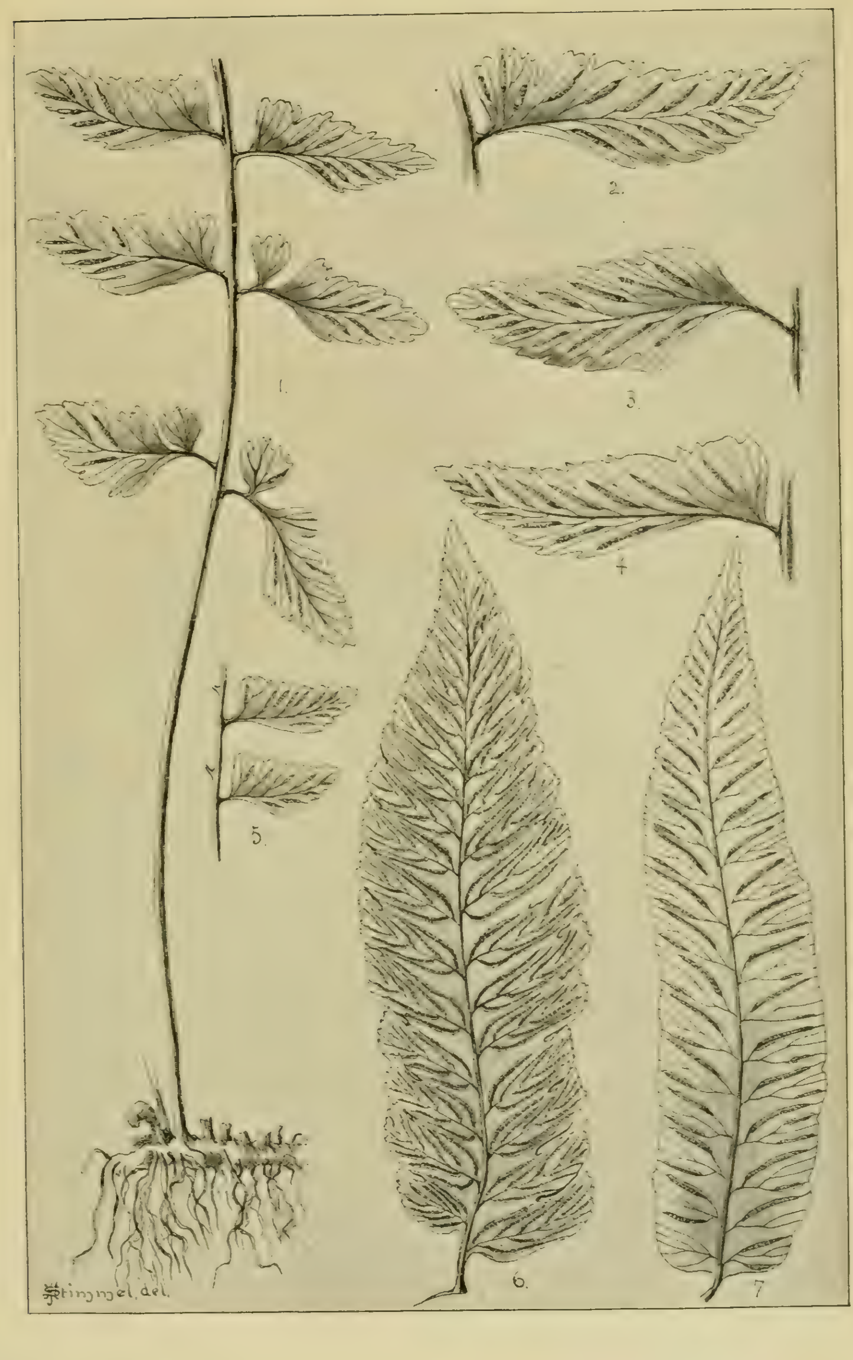
Asplenium celtidifolium Kze. p. 162.

Fig. 6. A pinna. The sori are all distinctly diplazioid. × 1.

Asplenium sylvaticum Presl. p. 163.

Fig. 7. A pinna. The sori all diplazioid. × 1.

PLATE XV.


1.
2.
3.
4.
5.
6.
7
Stimmel, del.

EXPLANATION OF PLATE XVI.

Asplenium sylvaticum Presl. p 163.

Figs. 1, 2. Pinnæ, showing variation in margin. × 1.

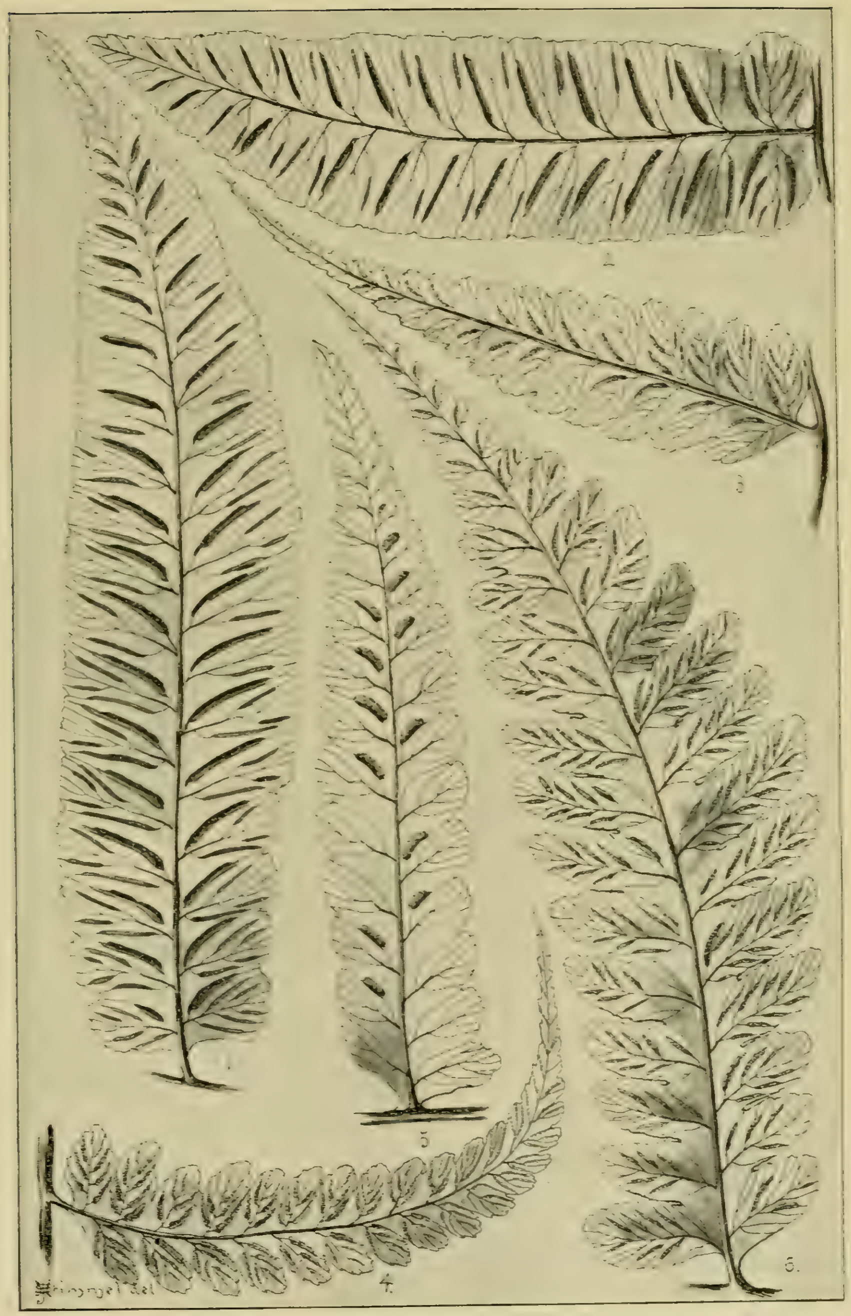
Asplenium shepherdi Spreng. p. 164.

Figs. 3, 4. Pinnæ from different fronds. None of the sori reach the midrib. × 1.

Asplenium radicans Schk. p. 164.

Fig. 5. Pinna. None of the sori diplazioid. × 1.
Fig. 6. Pinna. Some of the sori diplazioid. × 1.

PLATE XVI.


1
2
3
4.
5
6.
Shingel del.

EXPLANATION OF PLATE XVII.

Hemitelia grandifolia (Willd.) Spreng. p. 167.

Fig. 1. Two lobes of a pinna. The sori are usually more regularly arranged. × 1.

Hemitelia nigricans Presl. p. 167.

Fig. 2. Two pairs of pinnules, with winged secondary rachis. × 1.

Fig. 3. A larger pinnule. × 1.

Alsophila phegopteroides Hook. p. 168.

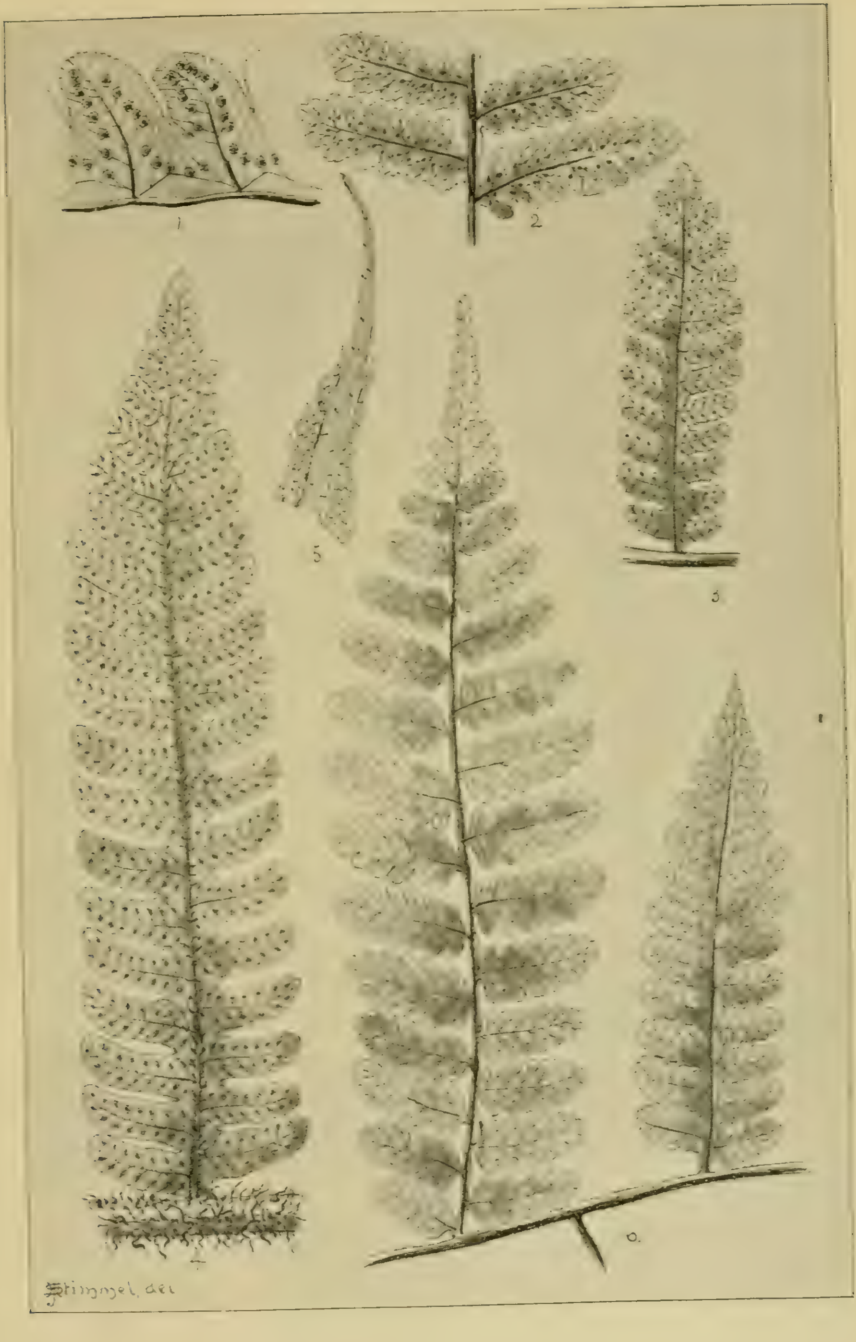
Fig. 4. A pinna with piece of scaly rachis.

Fig. 5. A scale from the rachis. Magnified.

Alsophila infesta Kze. p. 168.

Fig. 6. Two pinnæ showing the abrupt change from twice-pinnate to once-pinnate division toward the apex of the frond. × 1.

PLATE XVII.


1
2
5
3
6.
Stimmel, del.

EXPLANATION OF PLATE XVIII.

Hypoderris seemanni Prent. p. 169.

Fig. 1. Two lobes from the terminal division of a fertile frond. × 1.

Fig. 2. An involucre, with sporangia removed, showing the ciliated lobes. The upper, or open, part of the involucre is next to the margin of the frond in both figs. 2 and 3. Magnified.

Fig. 3. An involucre of one large scale. Magnified.

Nephrodium conterminum (Willd.) Desv. p. 172.

Fig. 4. An indusium, with a few sporangia adhering to the margin. Magnified.

Nephrodium mexicanum Presl. p. 173.

Fig. 5. A sterile pinna. The broader side uppermost. × 1.

Nephrodium sphærocarpum (Fée) Hook. p. 174.

Fig. 6. A fertile pinna. The broader side uppermost. × 1.

Nephrodium karwinskyanum (Mett.) Bak. p. 174.

Fig. 7. A pinnule. The largest lobe at base is uppermost. × 1.

Fig. 8. An indusium, with slightly ciliated margin. Magnified.

Nephrodium effusum (Swz.) Bak. p. 175.

Fig. 9. A segment. The largest lobe at base is uppermost. Compare with fig. 7. × 1.

Nephrodium parasiticum (L.) Shimek. p. 176.

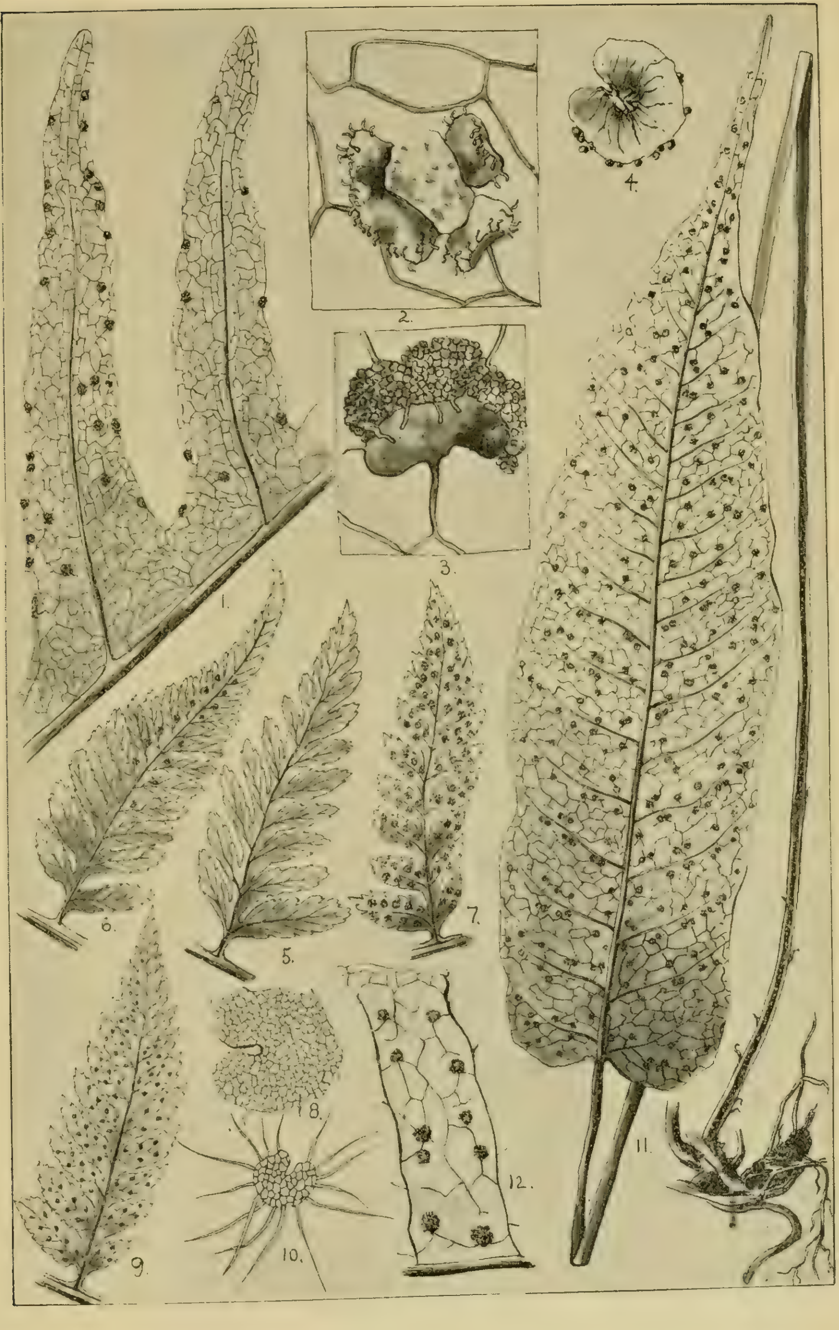
Fig 10. Indusium with long-ciliated margin. Magnified.

Nephrodium endresi Bak. p. 177.

Fig. 11. Frond with rootstock. × 1.

Fig. 12. Part of frond between two main ribs. × 2.

PLATE XVIII.


1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.

EXPLANATION OF PLATE XIX.

Phegopteris punctata (Thunb.) Mett. p. 182.

Fig. 1. The basal segment of the pinnule. The figure does not show the resin dots and lines on the veins. Magnified.

Fig. 2. Two scales from the base of the stipe. × 3½

Phegopteris tetragona var. *megaloda* (Schk.).—p. 183.

Fig. 3. Two lobes of pinna of a La Juana specimen. × 1.

Fig. 4. Two lobes of pinna of a Castillo specimen. × 1.

Phegopteris draconoptera (Eaton) Shimek. p. 184.

Fig. 5. One-half the frond, with rootstock. × ¼.

Fig. 6. A part of a lobe (or pinna) between two main veins, showing venation and sori. × 1.

Acrostichum tatei Bak. p. 185.

Fig. 7. A medium-sized sterile frond. The enlargements at the ends of the veins are represented somewhat too large. × 1.

Fig. 8. A fertile frond. The margin is sterile. × 1.

Acrostichum scolopendrifolium Raddi. p. 185.

Fig. 9. A part of sterile frond, showing midrib, venation, and hairy margin. × 1.

Fig. 10. A marginal scale. The basal part is cup-shaped. Magnified.

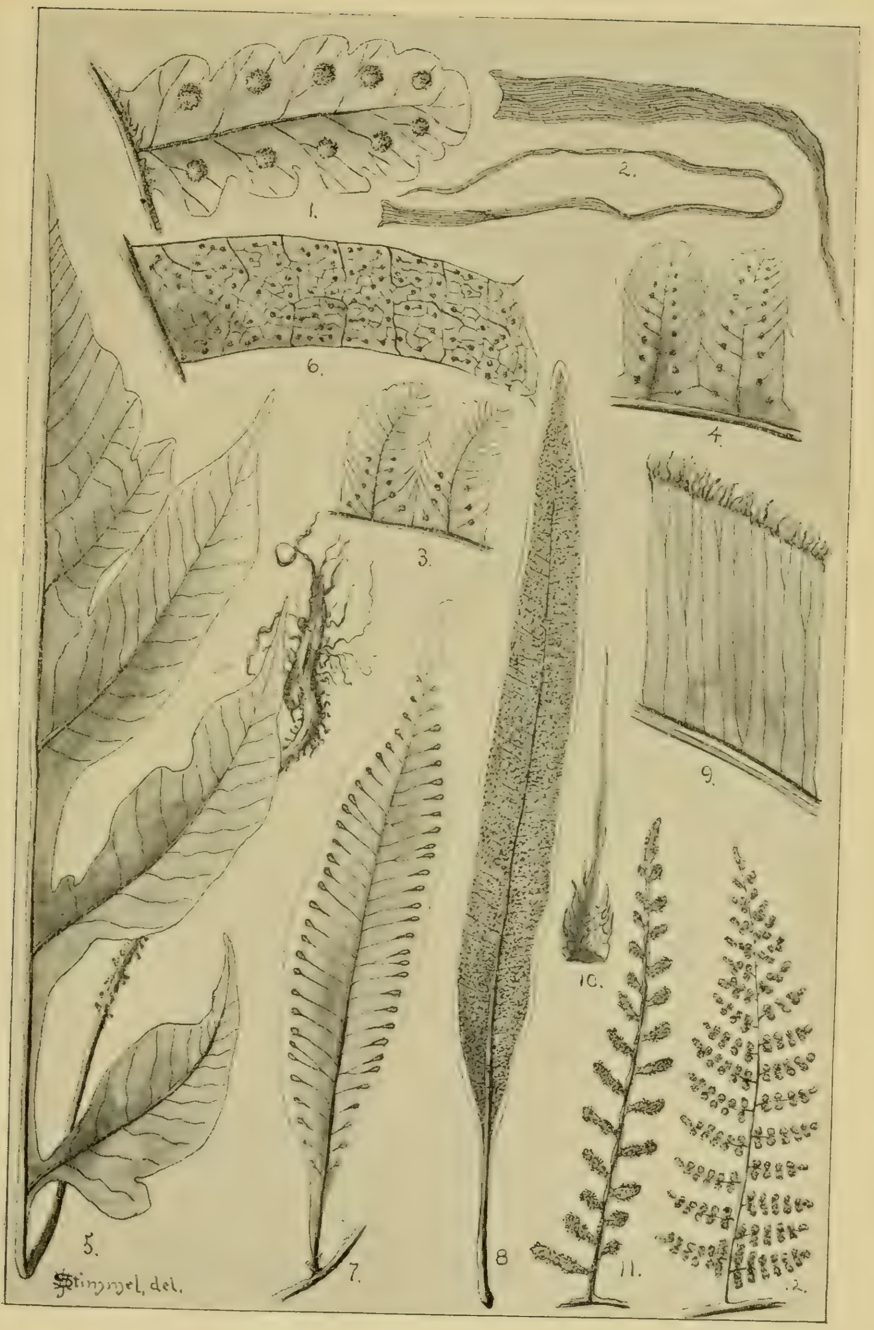
Acrostichum osmundaceum (H. B. K.) Hook. p. 186.

Fig. 11. A fertile pinnule. × 1.

Acrostichum canaliculatum (Klotzsch) Hook. p. 187.

Fig. 12. A fertile pinnule. × 1.

PLATE XIX.


1.
2.
6.
4.
3.
9.
10.
5.
7.
8
11.
12.
Stimmel, del.

Explanation of Plate XX.

Acrostichum osmundaceum (H. B. K.) Hook. p. 186.

Fig. 1. A sterile pinnule. × 1.

Acrostichum canaliculatum (Klotzsch) Hook. p. 187.

Fig. 2. A sterile pinnule. × 1.

Gymnogramma incisa M. et L. p. 191.

Fig. 3. One-half of a fertile frond. The base of the stipe, and the rootstock should be represented as decidedly scaly. × 1.

Fig. 4. The basal pinna of the broadest form. × 1.

Fig. 5. The tip of a pinnule, showing margin, apex, venation and sori. The surface should be represented as more hairy. Magnified.

Polypodium macbridense Shimek. p. 199.

Fig. 6. Scale from rachis. It was attached at the dark area. Magnified.

Fig. 7. Tip of a frond, lower surface. × 1.

Fig. 8. Two pairs of pinnæ of the broadest frond in the collection. × 1.

Fig. 9. One-half of a fertile frond. × 1.

Polypodium lævigatum Cav. p. 201.

Fig. 10. Part of frond between two main veins. × 2.

Polypodium repens L. p. 201.

Fig. 11. Part of frond between two main veins. × 2.

Polypodium phyllitidis L. p. 202.

Fig. 12. Part of frond between two main veins, from the narrow form. The venation is typical. × 2.

Fig. 13. Similar portion of the broad form from Castillo. The venation is peculiar, there being three rows of areolæ between the main veins. × 2.

Polypodium sororium H. B. K. p. 196.

Fig. 14. A pinna. The figure is inverted. × 1.

Polypodium loriceum L. p. 197.

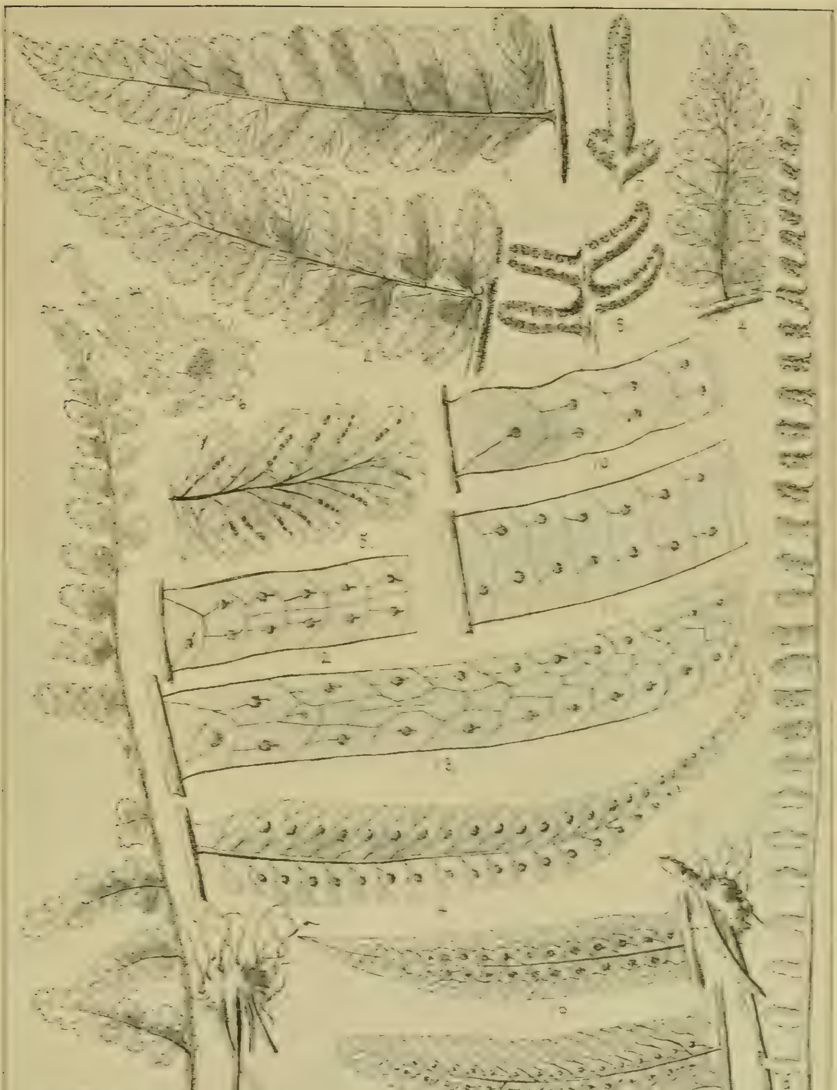
Fig 15. A pinna of the smooth blunt form from × 1.

Fig 16. A pinna of the hairy acute form from × 1.

Danæa crispa E. et R. p. 206.

Fig. 17. Two pairs of pinnæ and part of the winged rachis of a sterile ond. × 1.

PLATE XX.



PRICE, FIFTY CENTS.

VOL. IV. NO. 3.

BULLETIN

FROM THE

LABORATORIES OF NATURAL HISTORY

OF THE

STATE UNIVERSITY OF IOWA.

I. REPORT ON THE ACTINIARIA COLLECTED BY THE BAHAMA EXPEDITION OF THE STATE UNIVERSITY OF IOWA, 1893, . . . J. PLAYFAIR MCMURRICH

II. THE BRACHYURA OF THE BIOLOGICAL EXPEDITION TO THE FLORIDA KEYS AND THE BAHAMAS IN 1893, ... MARY J. RATHBUN

III. THE BEETLES OF SOUTHERN ARIZONA, . H. F. WICKHAM

PUBLISHED

BY AUTHORITY OF THE REGENTS.

IOWA CITY, IOWA:
JUNE, 1898.

Vol. IV. No. 3.

BULLETIN

FROM THE

LABORATORIES OF NATURAL HISTORY

OF THE

STATE UNIVERSITY OF IOWA.

PUBLISHED
BY AUTHORITY OF THE REGENTS.

IOWA CITY, IOWA:
JUNE, 1898.

Secretary WM. J. HADDOCK:

We take pleasure in submitting herewith Bulletin No. 3, of Volume IV, from the Laboratories of Natural History, of the State University of Iowa.

THE EDITORS.

REPORT ON THE ACTINIARIA COLLECTED BY THE BAHAMA EXPEDITION OF THE STATE UNIVERSITY OF IOWA, 1893.

BY DR. J. PLAYFAIR MCMURRICH.

THE chief interest of this collection, the examination of which I undertook at the request of Professor Nutting, lies in the number of deep water forms which it contains. Certain of these have been previously described, and I have been able to add to the earlier descriptions of these additional facts which, it is hoped, will render them more complete; but besides these, a number of apparently undescribed forms were found, some of which possessed considerable interest.

The littoral forms were not as abundantly represented as I had expected, but I found especial interest in a species of Adamsia, the study of which seemed to clear up the synonomy of the described American species of that group. My friend, Mr. J. E. Duerden, Curator of the Museum of the Institute of Jamaica has kindly answered many inquiries concerning some of these littoral forms and has sent me specimens for comparison; for these kindnesses I am under great obligations and it gives me much pleasure to make public acknowledgment of my indebtedness.

ORDER HEXACTINIÆ.

SUB-ORDER ACTININÆ.

FAMILY ANTHEOMORPHIDÆ *Hertwig*, 1882.

This family was established by Richard Hertwig ('82) for a form, *Antheomorphe elegans*, obtained by the Challenger expedition. Two other species, *Porponia elongata* and *P. robusta*, were also doubtfully referred to it, and later, in a supplementary report('88), a third genus *Ilyanthopsis* was added. The distinguishing characteristics of the family as given by Hertwig were the "slightly developed muscular system; long, slightly contractile tentacles, without any circular muscles (tentacles consequently non-retractile); reproductive organs present on all the septa; numerous complete septa; accessory tentacles wanting." It is to be noted, however, that none of the species referred to the family by Hertwig were suitably preserved for an exhaustive study, and some uncertainty exists as to the structure and arrangement of the mesenteries in all of them. Furthermore, if *Porponia elongata* is to be retained in the family it will be necessary to modify the definition as regards the distribution of the reproductive organs on all the mesenteries, since in the species mentioned imperfect non-gonophoric mesenteries occur.

In the collection made by the United States Fish Commission Steamer Albatross, I found a form which in my report ('93) I named *Halcurias pilatus*, referring it, chiefly on account of the arrangement of its mesenteries, to the family Halcampidæ. Carlgren ('93) has, however, shown that in two typical species of the genus Halcampa the sphincter muscle is mesoglœal and this added to the fact that Halcurias possesses an adherent base makes it advisable to remove it from the Halcampidæ. It seems to me that by modifying slightly the definition of the family Antheomorphidæ a place may be found for it in that group, in fact I was inclined at first to associate it with Porponia and was only deterred from doing so by the simplicity of the arrangement of its mesenteries. I would suggest as a definition of the Antheomorphidæ the following:

Actininæ with an adherent base; column smooth; tentacles simple, long or moderately so, conical or digitiform; sphincter muscle and acrorhagi wanting; no cinclides or acontia; no conchula; mesenteries all or nearly all perfect, all (?) the perfect ones gonophoric.

As Hertwig has pointed out the chief difference between the Antheomorphidæ and the Antheadæ lies in that in the former there is no sphincter muscle while in the latter it is present but feebly developed. Whether this is sufficient to recognize them as distinct families remains to be seen.

Genus HALCURIAS *McMurrich*, 1893.

In my original definition of this genus I laid stress on the fact that four pairs of mesenteries were less developed than the other six; this difference is by no means evident in the specimens I have found in the present collection and is probably due to the stage of development of the individual. It will be necessary accordingly to slightly modify the original definition, so that it may read thus:

Antheomorphidæ with tentacles only moderately long and conical; with ten pairs of mesenteries all of which are perfect and provided with well developed muscle pennons.

1. Halcurias pilatus *McMurrich*, 1893.

Station No. 29. Sand Key light bearing N. about 6 miles; 116 fathoms; 5 specimens.

Station No. 64. American Shoal light bearing N. by W. about 8 miles; 110 fathoms; 1 specimen.

This species I originally described ('93) from specimens collected by the United States Fish Commission in lat. 48° 09′ S.; long. 74° 36′ W., at a depth of 449 fathoms. The external appearance of the specimens in the present collection is somewhat different from that shown by the Fish Commission specimens and it was only when I came to study the anatomy that the identity became evident. The differences are, however, probably due to the methods of preservation; in the present specimens the column is more cylindrical and longer in proportion to its breadth and the color of the specimens is a creamy white, the Fish Commission specimens being of a dirty brownish color with indistinct indications of darker longitudinal bands. This difference in color may be due to the almost complete loss of the ectoderm in the Iowa University specimens, the white mesoglœa being exposed.

The base in both sets of specimens is slightly less in diameter than the column and appears to have been but feebly adherent. Its diameter in the specimens from Station 29 was 1–1.5 cm., the height of the column in the same specimens varying from 1.5 cm. to 2.5 cm. The single specimen from station 64 had, however, much greater dimensions, its base measuring nearly 2 cm. in diameter while the height of its column was 4 cm. A figure of this specimen of about natural size is given in Pl. 1, Fig. 1.

As a supplement to the original description I give a couple of figures from the present specimens. Pl. 1, Fig. 2 shows the absence of a sphincter muscle and also the sudden cessation of the thickness of the column mesoglœa just at the bases of the tentacles, a distinct parapet being thus formed. The nematocysts found in the ectoderm of the Fish Commission specimens could be seen in the present forms in the few patches of ectoderm which persisted and seemed to be especially abundant at the edge of the parapet. The ectodermal musculature of the column was also visible, though with considerable indistinctness owing to the extensive maceration which all the specimens had suffered. The tentacles in the specimens from Station 29 seemed to be about forty to forty-five in number, but in the large specimen I counted fifty-four and, allowing for a portion of the margin which was injured, the total number must have been over sixty.

The preparation from which Fig. 3 was drawn was a transverse section through the upper part of the column of one of the smaller specimens from Station 29, and is given for comparison with Fig. 14, Pl. XXI of my Fish Commission report ('93). The general structure of the mesenteries and their musculature were the same as in the Fish Commission specimens, allowance being made for the difference in size and probably therefore of age of the two examples. Ten pairs of mesenteries were present, but, although some of the mesenteries were smaller than others, I could not make out any definite arrangement of the large and small mesenteries. I cannot make any statement as to the arrangement of the reproductive organs since only a few scattered ova were to be found in the specimens examined. The mesoglœal ridges of the stomatodæum in the present specimens were much stouter than in the Fish Commission examples, though of the same general form. There were from twelve to fourteen of these ridges in the Station 29 specimens and about twenty in the large specimen from Station 64. Only one siphonoglyph was well marked, although there were two pairs of directives.

The structural differences between the West Indian specimens and those collected by the Fish Commission are but small and do not seem to warrant the establishment of a new species. They are in all probability referable partly to the method of preservation and partly to age.

A word may possibly be in order as to the suggestion of Carlgren ('93) that this form should be referred to his order Protantheæ. I must dissent from such an arrangement, as I do not think that the order can stand, based as it is solely on the occurrence of an ectodermal musculature in the column wall. It is true that this characteristic may be regarded in one sense as primitive, but it is a long journey back from the Hexactiniæ to the Scyphistoma to find the origin of it. It seems to me much more probably a sporadic resurrection of an ancestral characteristic and that it has little phylogenetic significance. The acceptance of it as of classificatory importance will lead to the association of forms which in other respects appear to have widely different affinities, *e. g.*, Gonactinia with Corallimorphus (?) and the form described by Hertwig ('88) as Corynactis sp.? I believe the development of the mesenteries to be a much more reliable phylogenetic character and I see no reason for the obliteration of the order Protactiniæ which is based on this feature. It may be noted that this order is much more comprehensive than Carlgren's Protantheæ, and in view of our present more complete knowledge of the forms in the past associated in the family Halcampidæ, I would even suggest the propriety of increasing its comprehensiveness by including many of these within it. This is an idea which, however, will require considerable discussion hardly appropriate to this report, and I must defer a consideration of it to a future occasion.

FAMILY ANTHEADÆ *Hertwig*, 1888.

2. CONDYLACTIS PASSIFLORA *Duch. & Mich.*, 1866.

The Dry Tortugas; 1 specimen.

There was no room for doubt as to the identification of this specimen and as the species had already been studied (McMurrich, '89) I did not think it necessary to mutilate the single example of it in the collection.

FAMILY BOLOCERIDÆ *McMurrich*, 1893.

3. BOLOCERA POLLENS sp. nov.

Station No. 64. American Shoal light bearing N. by W. about 8 miles; 110 fathoms; 1 specimen.

The single specimen which I regard as the type of a new species of Bolocera was obtained at the same station as the large specimen of Halcurias. It was badly distorted and rather poorly preserved and I contented myself with cutting out a small portion of the margin for an examination of the sphincter and with removing some of the tentacles for a study of their sphincters. The results of this partial examination were, however, so decisive that I think there can be no doubt but that we have to do with an undescribed species.

In its general appearance the specimen resembled greatly *B. pannosa* which I described for the Albatross collection (McMurrich, '93), having the same flaccid tentacles and being approximately of the same size. On account of the distortion which the specimen had suffered it was difficult to obtain exact dimensions, but the base measured about 2.8 cm. in diameter and the column about 1.2 cm. in height. The lower portion of the column was smooth or shows only fine longitudinal lines due to contraction, but the upper part for a distance of about 0.5 cm. from the margin had a very irregular surface, appearing as if verrucose, though it is impossible on account of the poor preservation to say that verrucæ were actually present. The sphincter was remarkably strong, more so than in any of the hitherto described species of Bolocera, and consisted of a median axis provided with very numerous lateral lamellæ arranged pinnately (Fig. 4).

The tentacles were about 1.6 cm. in length and, as is usual in the Boloceridæ, were attached to the disk by a narrow neck, beyond which they suddenly enlarged to a somewhat bulbous form, tapering off distally to a more slender portion. The longitudinal ridges with which they were provided were very numerous and low, so that they were evident only on close scrutiny. The only trace of color persisting in the specimen was found in the tentacles, which, especially in the bulbous portion, were of a brownish purple color. The sphincter of the tentacles, which occurs just distal to the narrow neck, was thickened at its free edge, where it bore muscle processes, one of which, with lateral secondary processes, was especially long and projected into the lumen of the tentacle towards its apex. This process, however, did not seem to be equally developed all around the sphincter fold, sections which passed through the axis of the tentacle showing it in some cases only on one side (Fig. 5).

In most of the species of Bolocera which have been studied anatomically the sphincter is of the diffuse endodermal type. This is the case with *B. brevicornis* and *B. longicornis* where it is typically diffuse; and in *B. occidua* and *B. kerguelensis*, in which, however, there is an indication of circumscription in that in the upper portion of the muscle there is a strong mesoglœal process which bears secondary pinnately arranged processes, the whole not projecting, however, much beyond the general mass of the sphincter.[1] In *B. pannosa* this upper process of the sphincter becomes of greater importance compared with the remaining processes, forming a condition which leads, through *Liponema multiporum* (Hertwig, '82 and '88), which I have elsewhere ('93) shown to be almost certainly a Bolocera, to the typically circumscribed sphincter of *B. pollens*.

---

[1] Practically the same arrangement I have found in forms from the east coast of North America identified by Verrill ('73, '83, etc.) with *B. tuediæ* (Johnston) Gosse. This identification is, however, open to question until the anatomical characteristics of the European and American forms have been compared.

The occurrence of such a sphincter is of importance in determining the family affinities of Bolocera. As is well known, Gosse in establishing the genus, assigned it to the family Bunodidæ and succeeding authors followed his example until 1891 when Carlgren, relying on the nature of the sphincter of *B. longicornis*, transferred the genus to the Antheadæ. In 1893 I proposed the establishment of the family Boloceridæ, a step which received the approbation of Carlgren ('93). Recently, however, objections have been made to this family by Kwietniewski ('96), who prefers to retain the genus among the Antheadæ. The occurence of the remarkably circumscribed sphincter of *B. pollens* renders this position untenable, and the diffuse sphincter of *B. brevicornis* and *B. longicornis* excluding the genus from the Bunodidæ, the recognition of a special family for it seems to be necessary.

FAMILY PHYLLACTIDÆ.

4. ASTERACTIS EXPANSA *Duerden*

Bahia Honda, Cuba; 26 specimens.

A description of this species has been written by my friend, Mr. Duerden, and will shortly be published with the necessary figures. Mr. Duerden has kindly allowed me to see his manuscript and has also sent me specimens for comparision with those in this collection; there can be no question as to the identity of the forms I have examined with those from Jamaica.

Mr. Duerden considers the species a new one and refers it to the genus Asteractis established by Verrill ('68). According to Verrill's definition the absence of verrucæ is one of the characteristics of this genus, and if this portion of the definition is to be retained the present species cannot be considered an Asteractis, even though the fronds, as in *A. bradleyi*, are arranged in cycles of different orders, those corresponding to the primary tentacles being the largest. Whether this arrangement of the fronds is a matter for generic distinction seems to me, however, exceedingly doubtful; in an earlier paper ('89) I accepted it as such, but the opportunities I have since had for studying members of the family Phyllactidæ have led me to modify my opinion in this respect. It seems to me that the shape and structure of the fronds is a more substantial feature for generic distinction than mere differences in the development of the primary, secondary and other cycles, and I cannot see that the structure of the fronds of the present species differs sufficiently from what occurs in Oulactis to warrant its separation from that genus. Whether the fronds of *A. bradleyi* differ sufficiently from those of Oulactis to warrant a new genus must remain a question until opportunity is afforded for a renewed study of this form: judging from Verrill's description they may be.

I am also in doubt as to the propriety of considering this a new species. Mr. Duerden has had opportunities for studying living specimens, and his judgment is accordingly worthy of great consideration, and I would merely suggest a possibility which occurred to me when studying the Cuban specimens. It is noticeable that the species seems to be fairly common on the Cuban coast judging by the number collected by the Iowa University expedition, and Mr. Duerden also finds it common in Jamaica; this makes me suspect that it may be identical with one of the forms described by earlier authors. With none, however, does it seem to agree very closely, though it seems to come nearest to *O. flosculifera* of Duchassaing and Michelotti ('60). In my original description of *O. flosculifera* ('89) I took it for granted that Duchassaing and Michelotti's identification was correct. Andres ('83) thinks otherwise and has separated the form described by these authors from Lesueur's *O. flosculifera* and named it *O. foliosa*. Perhaps after all Andres may have been right; the form which I described from the Bahamas agrees fairly well as to coloration with Lesueur's form, while the present form seems to agree more closely with that of Duchassaing and Michelotti. However the earlier descriptions are all too indefinite to make the identification certain and it will perhaps lessen the chances of confusion in the future to accept Mr. Duerden's separation of the present species under the specific name he has chosen.

FAMILY SAGARTIDÆ.

SUB-FAMILY SAGARTINÆ.

5. ADAMSIA TRICOLOR (*Lesueur*) *McMurrich.*

Synonyms:—*Actinia tricolor* Lesueur, 1817.
Actinia bicolor Lesueur, 1817.
Adamsia egletes Duchassaing & Michelotti, 1864.
Cereus sol Agassiz Ms. Verrill, 1864 (p.p.) .
Adamsia sol McMurrich, 1883.

Bahia Honda, Cuba; 1 specimen.

The base was evidently adherent, but though its ectoderm was preserved no signs of a horny secretion were present. The column was practically cylindrical, tapering slightly above and measured 2.7 cm. in height, the diameter near the base being about 2 cm., or rather since the column was flattened slightly the diameter in one direction was 2.5 cm. and in the other 1.5 cm.; near the margin it was 1.6 cm. and 0.9 cm.

The column wall was of a firm coriaceous texture and was marked by fine longitudinal and transverse lines probably due to contraction. The ectoderm was almost completely macerated away, the few fragments of it which persisted being of a dirty cream white color. A short distance above the base there were a number of purple brown spots or tubercles arranged in two horizontal rows; both rows were somewhat incomplete, some of the tubercles probably not being evident on account of the loss of the ectoderm. In the upper row I counted only four tubercles and in the lower only 6 (7?), the lower tubercles being considerably smaller than the upper ones.

The tentacles were marginal and were small and numerous, being too crowded to count accurately. Those of the innermost cycle were decidedly longer than those situated more peripherally and measured about 0.4 cm. in length. A faint rose-purple color persisted in the tentacles, but it was faint, the color of the entire specimen having been almost entirely extracted by the alcohol in which it was preserved. The disk and peristome could not be examined owing to the manner of contraction.

Sections through the column showed that the mesenteries were arranged in five cycles, of which only one cycle, consisting of six pairs, was perfect. Two pairs of directives were present. The fifth cycle was not quite complete in its development, some of the interspaces being destitute of representatives of it, and, throughout, its mesenteries were small and possessed no mesenterial filaments. Acontia were present but were few in number. The longitudinal musculature was only moderately developed, the mesoglœal processes covering a considerable portion of the surfaces of the mesenteries at the level of the lower part of the stomatodæum, but not being very high (Pl. I, Fig. 7). No parieto-basilar or basilar muscles were observed. The reproductive organs were borne upon the mesenteries of the second, third and fourth cycles, the specimen being a male.

The stomatodæum possessed two well developed siphonoglyphs and also was furnished with a number of longitudinal ridges, each of which was supported by an elevation of the mesoglœa.

The sphincter muscle was mesoglœal and well developed. It has a general triangular shape, occupying almost the entire thickness of the mesoglœa above but tapering off somewhat below, where it lies nearer the endodermal than the ectodermal surface (Pl. I, Fig. 6). Above it is finely reticular, bands of mesoglœa extending transversely from the inner to the outer surface of the muscle area, finer longitudinal strands breaking the intervals between successive bands into smaller compartments which are lined by the muscle cells supported on processes which project into the compartments (Pl. II, Fig. 1). About the middle of the muscle some of the longitudinal strands become thicker, and, being placed as it were end to end in successive intervals, produce the appearance of two or three longitudinal bands of mesoglœa. Below the partitions between the muscle-containing compartments thicken, so that the compartments become distinctly separated from one another, some even at the lower end of the muscle, being separated by considerable intervals from their fellows (Pl. II, Fig. 2).

Three species of Adamsia have been described from the West Indies; Lesueur ('17) has described two forms which he named *Actinia tricolor* and *Actinia bicolor*, the one from Barbadoes and the other from St. Vincent, while Duchassaing and Michelotti ('64) have described *Adamsia egletes* from St. Thomas. Of these three the one which seems to resemble most closely the form here described is *A. egletes* and I think there can be little doubt as to the identity of the two. The relationships of Lesueur's forms are more uncertain on account of the incompleteness of the descriptions, but I am inclined to consider them identical with *A. egletes*, so that but a single species of Adamsia is at present to be recognized in the West Indian region. My reasons for this belief are by no means conclusive, resting as they do upon circumstantial evidence, but I think they are sufficiently strong and my conclusion has received confirmation from my colleague, Mr. Duerden, who has had much experience with West Indian forms.

The habits of the genus Adamsia are such as to render probable the wide distribution throughout any region of a species occurring in it, and furthermore, so far as our present information extends, the distribution of the various species of Actinians throughout the West Indian islands is pretty uniform. One should hardly expect, I think, to find three species of Adamsia in different islands, especially since a form, *A. sol*, identical with the one here described, occurs on the coasts of North and South Carolina. I have examined carefully and compared *A. sol* with the Cuban specimen described above and I find such complete similarity in structural peculiarities that the identity of the two seems indubitable. With such an extensive distribution, the coasts of the Carolinas, Cuba, and

St. Thomas, one may well expect the same species to occur elsewhere throughout the West Indies.

As regards *A. bicolor*, it is unquestionably an Adamsia but the size given for it, "height and diameter about six or seven lines," indicates that it was a young individual and the differences between it and *A. tricolor* may well be accounted for on this supposition.

The first point in Lesueur's description of *A. tricolor* that may be noticed is the statement that the mouth is surrounded by "a circle of blue and another of orange." Here we have a very characteristic marking and turning to the description of *A. egletes* we find that it has a circle of red around the mouth. In both cases there is a distinct band of color around the mouth, and the discrepancy in the color of the band may, I think, be explained by a reference to *A. sol*, in which the lips are of a canary-yellow color (Lesueur's orange circle) and around this is a vivid circle of crimson lake, a color which may readily shade off into bluish on the one hand or red on the other. This marking seems to me very characteristic, and occurs, so far as is known, in no other species of Adamsia.

A seemingly important difference between *A. tricolor* and *A. egletes*, and one which led Duchassaing and Michelotti to regard the latter as a distinct species, is the statement that in *A. tricolor* there are several rows of cinclides. I think this difference is also capable of explanation, even leaving out of consideration the indefiniteness of the word "several," since in *A. sol* the lower row of cinclides is sometimes irregular and might suggest the occurrence of more than two rows, and I may further add that Mr. Duerden informs me by letter that from an examination of the species of Adamsia occurring in Jamaica and which he considers identical with *A. egletes* and *tricolor*, he believes that "little importance can be attached the arrangement of the cinclides." The tubercles which Lesueur describes as occurring around the mouth in *A. tricolor* are, I believe, merely the crenulations of the lips so frequently noticeable in Actinians and due to the longitudinal ridges of the stomatodæum; while the tubercles of the tentacle which are mentioned are probably merely an appearance produced by the coloration of the tentacles, such an appearance being thus produced in *A. sol.*

To sum up then it seems probable that *A. bicolor* is merely a young specimen of *A. tricolor*. The similarity of the locality and the characteristic color mark around the mouth indicate the identity of *A. tricolor* and *A. egletes;* the Cuban form here described is almost certainly identical with *A. egletes;* and finally the *A. sol* of the Carolinas is undoubtedly identical with the Cuban specimen. If this series of identities be accepted the name which has the priority is Lesueur's *A. tricolor* and the species should be known as *Adamsia tricolor* (Les.).

6. SAGARTIA SPONGICOLA *Verrill*, 1883.

Station No. 29. Sand Key light bearing N. about 6 miles; 116 fathoms; numerous specimens.

Station No. 51. American Shoal light bearing N. by W. 10 miles; about 100 fathoms; 3 specimens.

These specimens I have been able to compare with specimens from the collection of the United States Fish Commission identified by Professor Verrill and can accordingly vouch for the correctness of their identification. The base is of the adherent type and the column is nearly cylindrical, broadening slightly above and measuring from 2.3–2.5 cm. in height by about 1 cm. in diameter. In several specimens the dimensions fell considerably below these figures. The contraction of the column was incomplete in all the specimens, the tentacles being more or less exposed and the disk and peristome visible in some cases. The ectoderm had for the most most part macerated away in all the specimens, the patches of it which persisted having the dirty white color frequently seen in alcoholic material. The outer surface of the mesoglœa was raised into ridges, irregular in size and distribution and probably due to contraction. Small depressions were visible here and there on the column wall but I found no structures which I could positively regard as cinclides, nor any traces of verrucæ, such as Verrill ('83) describes on the upper part of the column.

The absence of ectoderm, however, probably accounts for my failure to find these structures.

The tentacles are marginal in position and are rather short, tapering gradually to a rather blunt extremity. They are arranged apparently in about three cycles and seem to be somewhat irregular in number, the two specimens in which I counted them possessing respectively 51 and 49; this irregularity is probably related to the peculiar arrangement of the mesenteries described below. The longitudinal musculature of the tentacles, which is ectodermal, was moderately developed, the mesoglœal processes being higher towards the base, and the radial musculature of the disk was considerably higher at the bases of the tentacles than elsewhere. The disk was smooth and the peristome somewhat elevated in those specimens in which it was visible.

The mouth was more or less circular in shape, the lips being crenated and the gonidial grooves not very well marked. Sections showed that the stomatodæum possessed several longitudinal ridges, due to thickening of the mesoglœa and producing the crenations of the lips. Two siphonoglyphs were present in all the specimens examined, and others, one or even two, were found in several cases; they were always, however, rather feebly developed and sometimes hardly distinguishable from the grooves of the general surface of the stomatodæum.

The arrangement of the mesenteries was very interesting, so much so as to induce me to give a special description of it elsewhere ('97); I may therefore, confine my remarks here to a general statement of the peculiarities which were found. The mesenteries were arranged in three cycles, only those of the first cycle being perfect. In different specimens, however, the first cycle consisted of either six, seven, or eight pairs, a hexamerous, heptamerous, or octamerous symmetry being thus produced, since the mesenteries of the second and third cycles were arranged in the intervals between those of the first cycle. Furthermore the directives were liable to considerable variety both in number and position, specimens having been found with two, three, or four pairs, and when only two pairs were present they were not opposite each other, but were separated on one side by one pair of the first cycle and on the other side by three pairs. These irregularities seem to be characteristic of the species, since out of seven specimens examined not one showed what is usually regarded as a typical arrangement. The condition described by G. Y. and A. F. Dixon ('89) for *Bunodes thallia* is thus recalled.

The longitudinal muscles of the perfect mesenteries were well developed, the long mesoglœal processes radiating out in a somewhat fan-like manner from a thickened portion of the mesentery (Pl. II, Fig. 3). The parieto-basilar muscle was also well developed on these mesenteries, but on those of the second and third cycles, which lack mesenterial filaments, the musculature was borne by a number of short processes arranged equally on both sides of the mesenteries, those on one side representing the longitudinal muscle processes and those on the other the parieto-basilar processes. Acontia were present but were few in number. I found reproductive organs in only two of the specimens examined and in these they occurred on the mesenteries of the first cycle, the directives included. In both cases, however, they were immature, though it seems probable that even when mature they are limited to the mesenteries of the first cycle, since those of the second and third cycles lack that portion of the mesentery which corresponds to the reproductive region of the first cycle mesenteries and possess only the muscular region.

A well developed sphincter of the mesoglœal type occurred in the upper part of the column wall. It was of an elongated oval form in section (Pl. II, Fig. 4) and the area which it occupied was traversed by numerous strands of mesoglœa, running in the direction of the thickness of the column wall and anastomosing somewhat so that the spaces occupied by the muscle fibres were somewhat spindle-shaped. The area occupied by the muscle was sharply marked off as a rule, though occasionally a few detached and scattered muscle cavities were observed.

Haddon ('89) has suggested the possible identity of this form with *Gephyra dohrnii.* Undoubtedly there is considerable external similarity between the two forms, but until a more thorough anatomical description is given of Gephyra their identity must be left an open question. Haddon states that anatomically Gephyra "belongs to the series of typical Sagartians," and from this statement, as well as from the fact that in all the specimens he examined the tentacles were arranged on a typically hexamerous plan, I should be inclined to doubt its identity with *S. spongicola*, which can hardly be called a "typical sagartian." Von Koch's description ('78) of the anatomy of Gephyra is too incomplete to throw any light upon the subject.

SUB-FAMILY PHELLINÆ.

7. ACTINAUGE LONGICORNIS *Verrill*, 1883.

Station No. 64. American Shoal light bearing N. by W. about 8 miles; about 40 fathoms; 1 specimen.

The single specimen which I refer to this species I was unwilling to injure, but I was able to compare it with a specimen from the United States Fish Commission and can state that so far as their external appearance was concerned the two specimens were practically identical. It is probable that the specimen belongs to Verrill's variety *caribæa*, though it seems questionable if there be good grounds for recognizing this as a distinct variety.

SUB-ORDER STICHODACTYLINÆ.

FAMILY DISCOSOMIDÆ.

8. DISCOSOMA ANEMONE (*Ellis*) *Duch.*

Spanish Wells; 13 specimens.

I have nothing to add to the description of this form which I have already published ('89).

ORDER ZOANTHEÆ.

FAMILY ZOANTHIDÆ.

9. ZOANTHUS SOCIATUS *Ellis*.

Dry Tortugas; 2 colonies.

Spanish Wells; 3 colonies.

I have compared these specimens with *Z. sociatus* from the Bahama Islands and can find no differences sufficient for their separation. All the colonies were adherent to blocks of coral rock somewhat uneven in shape, and, as a result, there is some difference in the size of the various individuals, since there seems to be a tendency for the disks of the expanded polyps to lie at approximately the same level. Those individuals which are situated in the depressions, or on the sides of a block, consequently grow to a greater height than those situated on elevations or on the general level. Thus in one of the colonies examined many of the individuals measured only 0.5 cm. in height, while others measured as much as 2 cm., these measurements being in both cases of individuals whose diameter slightly below the apex of the contracted column was about 0.5 cm. There were of course numerous small polyps recently budded off from the stolons, whose height was less than that given for the small adults, but these could be readily recognized by their small diameter.

I can add nothing to the description of *Z. sociatus* I have already published ('89), especially since the internal parts of the specimens examined were rather badly macerated. I give, however, in Pl. III, Fig. 1, a view of a transverse section of the sphincter, having omitted such a figure in my earlier paper.

10. PALYTHOA NIGRICANS sp. nov.

Station No. 24. Off Key West; Sand Key light bearing N. N.W., Key West light bearing N.; about 60 fathoms; 3 colonies on coral rock.

I have adopted for the Zoantheæ the generic definitions as given by Haddon and Shackleton ('91 and '91 *bis*), and consequently refer this form, which according to Erdmann's classification ('85) would be regarded as a Corticifera, to the genus Palythoa.

The colonies form compact masses, with a thickness of about 1–1.5 cm., the individual polyps measuring on an average about 0.7 cm. in diameter. As in other members of the genus they are imbedded in cœnenchyme throughout the greater portion of their length, only the upper part of each individual being free, though it is to be noted that even the most contracted individuals project somewhat above the general level of the cœnenchyme. Many of the individuals were, however, only partially contracted, the mouth and a portion of the disk being frequently visible, but in all cases the tentacles were curled in beneath the margin so that they could not be counted. The general color of the preserved colonies was yellowish sandy, the color deepening towards the bases of the tentacles to what is almost orange. The disk is apparently of a lighter shade than the column and a considerable quantity of black pigment, in the form of granules, occurs in the endoderm of the mesenteries especially towards their inner ends below the level of the stomatodæum, and also in the lacunar spaces of the lower portion of the column wall and in the basal lacunæ of the mesenteries. As a result of the presence of this pigment the lower portions of the colonies have a greyish black color, very distinctly seen when a portion of a colony is cut away or when the base of the colony is examined.

The mesoglœa is throughout thickly studded with foreign particles, mostly irregular fragments of carbonate of lime, though foraminiferous shells and sponge spicules also occur. In sections through decalcified specimens the column wall has a fenestrated appearance owing to the imbedded particles having been dissolved out (Pl. III, Fig. 6). Of the ectoderm little can be said, as the preservation of the material was by no means what was to be desired, but apparently it was not divided into compartments by lamellæ of mesoglœa as in

Zoanthus, nor did it seem to be covered by a sub-epidermal layer of mesoglœa.

The upper part of each polyp showed a number of ridges radiating, in the completely contracted specimens, from the center of the upper surface of the column; they were not, however, very distinctly marked. The mouth is small and oval or slit-like in form and the stomatodæum presents the usual single siphonoglyph, whose mesoglœa is thickened and has the truncate form noted for other species of Palythoa.

Sections show that the mesenteries are arranged on the brachycnemic plan; I counted in one specimen eighteen pairs and in another twenty. The individual mesenteries are very thin, and each is provided with elongated basal lacuna, which in the lower part of the column becomes almost circular. I can say nothing regarding the musculature of the mesenteries, the internal parts being in a very imperfect state of preservation; I should judge, however, that the longitudinal musculature was very weak as I could find no traces of mesoglœal processes for its support. Reproductive organs, spermatozoa, occurred very abundantly in the lower portions of the mesenteries and the species seems to be unisexual; in fact all the individuals of a colony seem to be of the same sex, since specimens taken from various parts of one colony all possess only spermatozoa.

The sphincter muscle is moderately long but narrow, consisting practically of but a single row of cavities (Pl. III, Fig. 7). It is, of course, mesoglœal.

In its general appearance this species resembles the *P. mammillosa* of Duchassaing and Michelotti as represented in their Pl. VI, Fig. 10 ('64), but it must be observed that they include *P. ocellata* and *P. flava* under this title, an alliance which may possibly be correct for *P. flava*, but not, I believe, for *P. ocellata*. The present species differs from the figure of *P. mammillosa* given by Ellis and Solander ("86) in that the polyps at the edge of the colony are not at all, or but slightly, separated by longitudinal grooves, a fact which may or may not be of importance, and apparently *P. mammillosa*

EXPLANATION OF PLATE I.

Fig. 1. *Halcurias pilatus* from Station No. 64. About natural size.

Fig. 2. Longitudinal section through the upper part of the column of *Halcurias pilatus*, showing the absence of a sphincter muscle.

Fig. 3. Transverse section through a portion of the column of *Halcurias pilatus* in the stomatodæal region. D=directive mesenteries; si=siphonoglyphs.

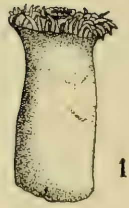
Fig. 4. Transverse section of the sphincter muscle of *Bolocera pollens*.

Fig. 5. Longitudinal section through the basal portion of a tentacle of *Bolocera pollens*, to show the tentacular sphincter.

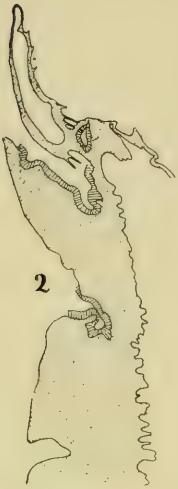
Fig. 6. Transverse section through the sphincter of *Adamsia tricolor*, to show its general form.

Fig. 7. Transverse section through a pair of mesenteries of the first cycle of *Adamsia tricolor* in the stomatodæal region.

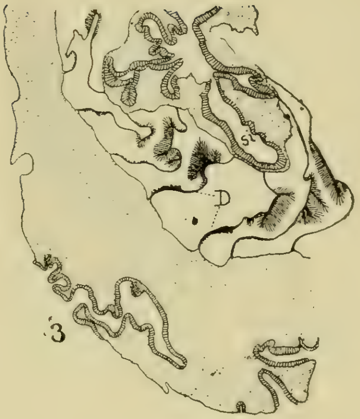
PLATE I.



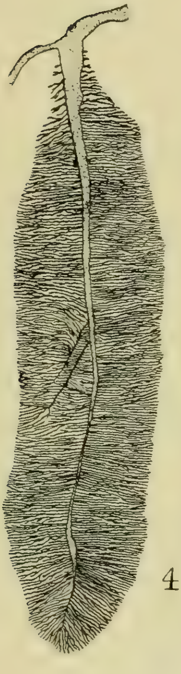
1



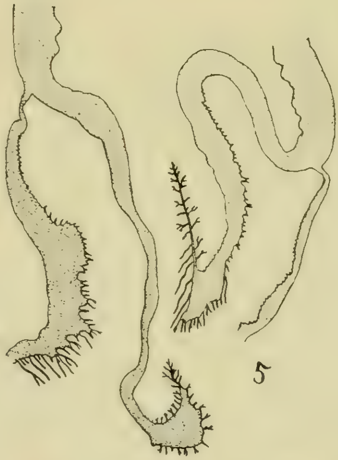
2



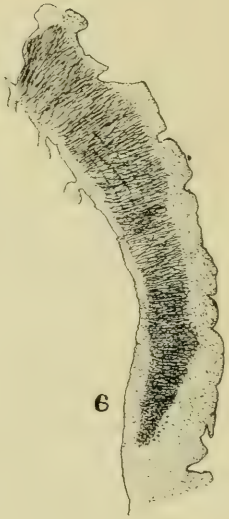
3



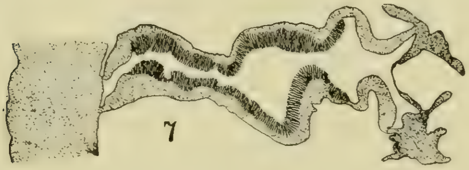
4



5



6



7

EXPLANATION OF PLATE II.

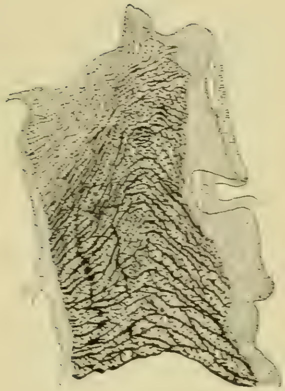
Fig. 1. Transverse section through the upper part of the sphincter of *Adamsia tricolor.*

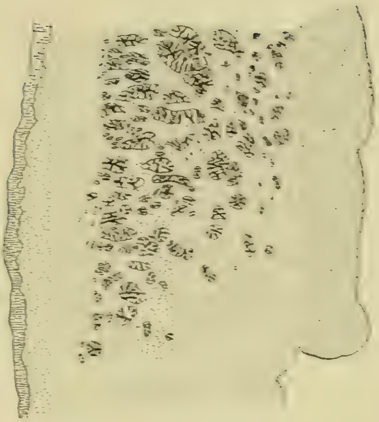
Fig. 2. Transverse section through the lower part of the sphincter of *Adamsia tricolor.* This figure was drawn under higher magnification than the preceding one.

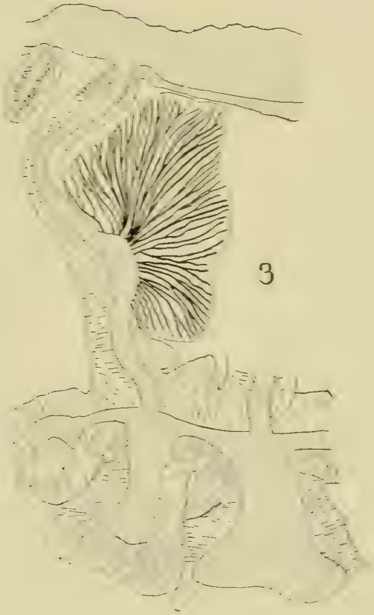
Fig. 3. Transverse section through mesenteries of the first and third cycles of *Sagartia spongicola.*

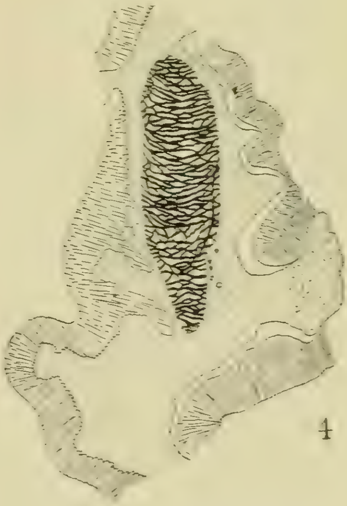
Fig. 4. Transverse section through the sphincter muscle of *Sagartia spongicola.*

PLATE II.


1


2


3


4

Explanation of Plate III.

Fig. 1. Transverse section through the sphincter muscle of *Zoanthus sociatus.*

Fig. 2. *Epizoanthus hians* on worm tube. About natural size.

Fig. 3 Longitudinal section through the upper part of the column of *Epizoanthus hians.* st=stomatodæum; sp=sphincter; t=tentacle.

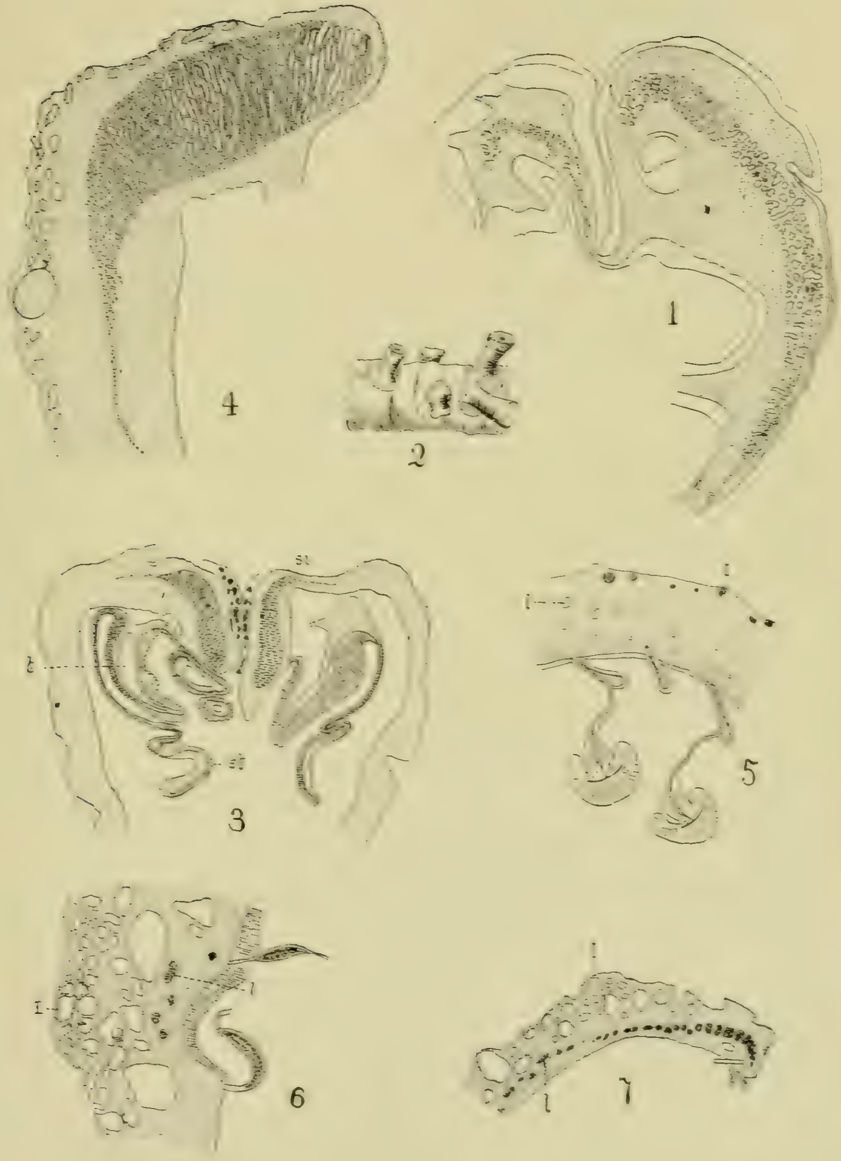
Fig. 4. Transverse section through the sphincter muscle of *Epizoanthus hians.*

Fig. 5. Transverse section through a portion of the column wall and mesenteries of *Epizoanthus hians*, below the level of the stomatodæum. I=inclusions in mesoglœa; l=lacunæ.

Fig. 6. Transverse section through part of the column wall of *Palythoa nigricans.* I=inclusions in mesoglœa; l=lacunæ.

Fig. 7. Longitudinal section through the upper part of the column wall of *Palythoa nigricans.* sp=sphincter muscle; I=inclusions in mesoglœa; l=lacunæ.

PLATE III.


4
1
2
st
t
st
3
l
l
5
l
6
l
7
l

did not posses black pigment in its endoderm, as no mention is made of it, although individuals of a colony were dissected. In fact the occurrence of this black pigment in the present species seems to separate it from all hitherto described species from the West Indies, except the *P. lutea* of Hertwig and Erdmann from the Bermudas, in which "Das ganze entodermale Epithel is mit dunkeln Körnchen pigmentiert" (Erdmann '85). This form is, however, very different from the present one, judging from the figure of a colony given by Erdmann and Hertwig ('88).

In addition to the occurrence of the pigment the shape of the sphincter also serves to separate the form now under discussion from *P. ocellata* and *P. flava*, it being much shorter and weaker, and a distinguishing feature is also found in the greater amount of foreign matter contained in its mesoglœa, sections of its column wall appearing when decalcified much more fenestrated than in either of the species just mentioned. From *P. cinerea* Duch. and Mich. it seems to be distinguished by the lesser size of its polyps, and from *P. glutinosa* Duch. and Mich., *P. caribœa* Duch. and Mich., *P. glareola* Lesueur, and *P. lutea* Hertwig it differs in the marked projection of the contracted polyps above the general surface of the cœnenchyme.

With none of the West Indian species of Palythoa then does it appear to agree, nor do I see any reason for identifying it with any of the species described from other localities. The depth from which it was taken does not seem to be sufficient to preclude its identity with one of the littoral forms, and yet it seems to be decidedly different from any at present known. How far the occurrence of the black pigment is a specific characteristic remains to be seen, but it seems improbable that it is merely a local or a seasonal peculiarity.

11. EPIZOANTHUS HIANS sp. nov.

Station No. 51. American Shoal light bearing N. by W. 10 miles; about 100 fathoms.

Station No. 52. American Shoal light bearing N. by W. ½ W.; about 10 miles; 105–110 fathoms.

Station No. 28. Sand Key light bearing N. about 6 miles; 116 fathoms.

Tank 8.

This form, which appears to be a new species, was abundantly represented in the collection. The individuals occur singly or in groups of from two to four, arising from a low flat plate of cœnenchyme, and are free throughout their entire length (Pl. III, Fig. 2). The colonies occur principally on sponges, though also on tubes of Hyalinœcia (?) and, in case of the specimens from Station 52 on a branching, dense, calcareous substratum which seems to be a millepore, and on the serpulid tubes which twined around the base of this.

All the specimens are completely contracted, the extremity of the column in the majority being flattened and marked by a number of ridges radiating out from the central depression. The various individuals vary somewhat in size, the largest having a height of about 1.4 cm., and a diameter at the top of the column of 0.5 cm., but many individuals were only 0.2–0.3 cm. in height with a diameter of about the same; gradations between these two extremes occur in abundance. The wall is firm and on a superficial view shows no trace of foreign incrustation, though sections reveal foreign matter such as sand and sponge spicules imbedded in the outer part of the mesoglœa fairly abundantly on the upper part of the column, but more scantily below. The introverted portion of the column has the inclusions most abundant. No trace of color persists in any of the specimens.

The tentacles are arranged in two cycles. Their musculature is fairly well developed, and in their mesoglœa sponge spicules and foraminferous shells are imbedded, especially towards their bases, but also less abundantly throughout almost their entire length.

The mouth is large and in all the specimens examined was widely open, the tips of the tentacles projecting into it (Pl. III, Fig. 3). The stomatodæum is short and is furnished as usual with a single siphonoglyph, moderately deep and with the mesoglœa of its walls considerably thickened.

The mesenteries are arranged on the macrocnemic plan. In two specimens I counted in each twenty mesenteries on one side and twenty-one on the other. The shape of the perfect mesenteries is somewhat peculiar. The basal portion of each is thickened and distinctly club-shaped, the longitudinal musculature being situated on one surface of this portion, and from a little below the tip of the club a very thin lamella begins, which terminates at its free edge in the mesenterial filament and bears the reproductive organs when these are developed (Pl. III, Fig. 5). In one specimen examined, ova were found in this thin portion of the perfect mesenteries and there were no signs of spermatozoa, so that it may be presumed that the species is unisexual. The imperfect mesenteries resemble the muscular portion of the perfect ones, the gonophoric lamella and the mesenterial filaments being wanting. No basal lacunæ occurred in any of the mesenteries. Owing to the width of the stomatodæum and the consequent small space between it and the inner surface of the column wall the mesenteries are narrow, a feature especially noticeable in sections below the level of the stomatodæum since the mesenteries project only a relatively short distance into the cœlenteron and thus leave a large empty space in the center of the column.

The sphincter muscle (Pl. III, Fig. 4) is imbedded in the mesoglœa and is strong, especially that portion which is contained in the wall of the introverted portion of the column. At its upper end it is composed of numerous elongated cavities, whose long axes are at right angles to the column axis; further down the cavities become smaller and oval, though still occupying a considerable portion of the thickness of the column wall, but below the introvert it becomes rapidly reduced to a single row of small oval cavities which approach the endodermal surface of the mesoglœa as they are traced downwards.

The form which approaches this most nearly is that described by Erdmann ('85) as species 4, and named by Hertwig ('88) *E. stellaris*. It was obtained by the "Challenger" off one of the Philippine Islands. In the general form of the column this form differs greatly, however, from *E. hians*, and taking this into consideration with the localities from which the two forms were obtained it seems proper to regard the West Indian species as new.

University of Michigan,
July 28th, 1897.

LITERATURE.

'86. Ellis, J. and Solander, D. The Natural History of many curious and uncommon Zoöphytes, etc. London. 1786.

'17. Lesueur, C. A. Observations on several species of Actinia. Journ. Acad. Nat. Sci., Philadelphia. I. 1817.

'60. Duchassaing and Michelotti. Mémoire sur les Coralliaires des Antilles. Mém. Reale Accad. di Torino. 2nd Sér. XIX. 1860.

'64. Duchassaing and Michelotti. Supplément au Mémoire sur les Coralliaires des Antilles. Mém. Reale Accad. Torino. 2nd Sér. XXIII. 1864.

'68. Verrill, A. E. Review of the Corals and Polyps of the West Coast of America. Trans. Connecticut Acad. Arts and Sci. I. 1868.

'73. Verrill, A. E. Results of Recent Dredging Expeditions on the Coast of New England. American Journ. of Sci. and Arts. V. 1873.

'78. von Koch, G. Zur Phylogenie der Antipatharia. Morph. Jahrb. IV, Suppl. 1878.

'82. Hertwig, R. Report on the Actiniaria. Report of Sci. Results of H. M. S. Challenger. Zoölogy. VI. 1882.

'83. Verrill, A. E. Report on the Anthozoa and on some additional species dredged by the "Blake" 1877–79, and by the U. S. Fish Commission steamer, "Fish Hawk," in 1880–82. Bull. Museum Comp. Zoöl. XI. 1883.

'85. Erdmann, A. Ueber einige neue Zoantheen. Jenaische Zeitschr. XIX. 1885.

'88. Hertwig, R. Supplement to Report on the Actiniaria. Reports of the Sci. Results of Voyage of H. M. S. Challenger. Zoölogy. XXVI. 1888.

'89. McMurrich, J. P. The Actiniaria of the Bahama Islands, W. I. Journ. of Morph. III. 1889.

'89. Haddon, A. C. A Revision of the British Actiniæ. Part I. Sci. Trans. Royal Dublin Soc. 2nd Ser. IV. 1889.

'89. Dixon, G. Y. and A. F. Notes on Bunodes thallia, Bunodes verrucosa and Tealia crassicornis. Sci. Proc. Royal Dublin Soc. N. S. vi. 1889.

91. Haddon, A. C., and Shackleton, Alice M. A Revision of the British Actiniæ. Part ii. The Zoantheæ. Sci. Trans. Royal Dublin Soc. 2nd Ser. iv. 1891.

'91 bis. Haddon, A. C., and Shackleton, Alice M. Reports on collections made in Torres Straits by Professor A. C. Haddon, 1888–89. Actiniæ. I. Zoantheæ. Sci. Trans. Royal Dublin Soc. 2nd Ser. iv. 1891.

'91. Carlgren, O. Beiträge zur Kenntniss der Actinien-Gattung Bolocera Gosse. Ofvers. Kongl. Vet. Akad. Förhandl. 1891.

'93. McMurrich, J. P. Report on the Actiniæ collected by the U. S. Fish Commission steamer, Albatross, during the winter of 1887–88. Proc. U. S. Natl. Museum. xvi. 1893.

'93. Carlgren, O. Studien über nordische Actinien. I. Kongl. Svensk. Vet. Akad. Handl. xxv. 1893.

'96. Kwietniewski, C. R. Revision der Actinien welche von Herrn Prof. Studer auf der Reise der Korvette Gazelle um die Erde gesammelt worden. Jenaische Zeitschr. xxx. 1896.

'97. McMurrich, J. P. Contributions on the Morphology of the Actinozoa. iv. On some irregularities in the number of Directive Mesenteries in the Hexactiniæ. Zoöl. Bulletin. i. 1887.

THE BRACHYURA OF THE BIOLOGICAL EXPEDITION TO THE FLORIDA KEYS AND THE BAHAMAS IN 1893.

BY MARY J. RATHBUN,

SECOND ASSISTANT CURATOR, DEPARTMENT OF MARINE
INVERTEBRATES, U. S. NATIONAL MUSEUM.

THE first series of deep-sea dredgings off the coast of Florida by the United States Coast Survey, from 1867 to 1869, in which Count L. F. de Pourtales took charge of the dredging operations, yielded a large number of Brachyura which were described by Dr. William Stimpson in 1871.[1] The types were destroyed in the Chicago fire. A number of the species have not yet been rediscovered.

A preliminary report upon the Crustacea collected in the Gulf of Mexico and Caribbean Sea by the Coast Survey Steamer "Blake" (1877–1879), was made by Prof. A. Milne Edwards in 1880.[2] Full descriptions of all the West Indian maioid and cancroid crabs, with many illustrations, are given in "Études sur les Crustacés Podophthalmaires de la Région Mexicaine" which was published in Paris and issued in parts betweeen 1873 and 1880.

Subsequently a number of species have been described by myself in the Proceedings of the United States National Museum since 1891, and the Proceedings of the Biological Society of Washington, 1897. Other recent papers dealing with the Brachyura dredged in this region are those by Mr. J. E. Ives in the Proceedings of the Academy of Natural

---

[1] *Bull. Mus. Comp. Zool.*, II, No. 2, pp. 109–160.

[2] *Bull. Mus. Comp. Zool.*, VIII, No. 1, pp. 1–67.

Sciences of Philadelphia, 1891, by Dr. W. C. Kendall in the Bulletin of the United States Fish Commission, IX, 1891, and by Dr. Walter Faxon in the Bulletin of the Museum of Comparative Zoölogy, XXX, No. 3, 1896.

In the works above cited will be found references to the literature pertaining to the shore and shallow-water forms included in the following list.

The collection made by the Biological Expedition of the State University of Iowa in 1893 is notable not only for the number of species obtained, but for the careful preservation of the specimens. A number of species are here recorded for the first time since the original description. Six new species represented in the University collection are described; also eleven West Indian species in the National Museum collection, ten of which were obtained by the United States Fish Commission Steamer "Albatross" and one species (*Pilumnus andrewsii*) by Dr. E. A. Andrews at the Bahamas. These last are published by permission of the Secretary of the Smithsonian Institution. The species of the University collection are numbered from 1 to 128.

MAIIDÆ.

1. STENORYNCHUS SAGITTARIUS (*Fabricius*) (=LEPTOPODIA SAGITTARIA *Leach*).

Tortugas.

2. PODOCHELA RIISEI *Stimpson.*

Station 68, off Little Cat Island, Bahamas, on the submerged bank connecting it with Eleuthera, 3 to 13 fathoms; Bahia Honda, Cuba, on wharf.

3. PODOCHELA HYPOGLYPHA (*Stimpson*) (=P. SPATULIFRONS *A. Milne Edwards*).

Tortugas.

A variable species.

4. PODOCHELA LAMELLIGERA (*Stimpson*).

Station 24, off Key West, 60 fathoms.

5. PODOCHELA MACRODERA *Stimpson.*

Station 46, off Key West, shallow water; Sand Key Light, Florida, in rocks, sponges, etc.; Bahama Banks; Harbor Island, Bahamas.

6. PODOCHELA GRACILIPES *Stimpson.*

Stations 24, 27 and 39, off Key West, 20 to 60 fathoms.

7. EUCINETOPS BLAKIANA *Rathbun.*

Bahama Banks.

8. COLLODES DEPRESSUS *A. Milne Edwards.*

Station 24, off Key West, 60 fathoms.

9. COLLODES ARMATUS sp. nov. Pl. II, Fig. 1.

Off Havana.

Carapace smooth and unarmed above. Rostrum short, subtruncate. Ambulatory legs spinous beneath.

This species approaches nearer to *Collodes* than to any other known genus, although it differs in some respects from typical members of that genus. The unique specimen, a female, was captured in the tangles and was so thoroughly wrapped in the hemp fibres that in removing them many of the hairs of the appendages have been torn off.

The dorsal surface of the carapace is smooth and shining, without granulation or median spines. It is also nearly naked, but doubtless some hairs have been rubbed off. The carapace is narrower than in the other species of *Collodes;* the cardiac, branchial and gastric regions are much swollen. The hepatic region is depressed and bears on the margin a spinule and in advance one or more granules. The pterygostomian region is beset with ten or more sharp spines Front subtruncate, not advanced beyond the antennular fossæ, with a deep median sulcus terminating in the interantennular partition which projects slightly forward as a median tooth not visible in a dorsal view. Postorbital tooth triangular, shorter than the eye-stalks. Abdomen of the female with two median tubercles on the coalesced segment; surface covered with curved hairs. Basal antennal joint with an acute tooth at the antero-external angle; outer margin with four irregular lobes; inner margin with a shallow sinus, its anterior angle rounded. Maxillipeds spinulous.

The chelipeds as usual in the female are slender; the margins are spinous, the largest spines on the outer margin of the merus and the inner margin of the carpus. The manus is slender, unarmed distally; the fingers are nearly as long as the palm and are in contact. The ambulatory legs are long, slender and of nearly equal length. They are margined with long straight bristles set in short, stout, cylindrical sockets, which remain as hard, bead-like projections when the bristles are removed. There are also a few curved hairs, and the first two pairs of legs are furnished underneath with sharp spines.

Dimensions.—Length of carapace, 9 mm.; width, 6.8; approximate length of ambulatory legs, as follows: first, 20.4; second, 21; third, 21; fourth, 20 mm.

10. EUPROGNATHA RASTELLIFERA *Stimpson.*

Stations 27, 35, 47 and 48, off Key West, 50 to 90 fathoms; stations 28, 29, 33, 41 and 42, off Sand Key, 15 to 116 fathoms; stations 51 and 62, off American Shoal, 70 to about 100 fathoms; station 56, Pourtales Plateau, about 200 fathoms; off Havana.

These specimens are the form which I described in 1894 as a subspecies, *Euprognatha rastellifera spinosa*, but as most of them were obtained from the same locality as Stimpson's types, it is probable that this is the typical form of *E. rastellifera.*

11. EUPROGNATHA GRACILIPES *A. Milne Edwards.*

Off Havana.

12. ARACHNOPSIS FILIPES *Stimpson.*

Stations 24, 27, 29, 39, 41, off Key West and Sand Key, 15 to 116 fathoms.

13. ÆPINUS SEPTEMSPINOSUS (*A. Milne Edwards*) (=APOCREMNUS SEPTEMSPINOSUS *A. Milne Edwards.*)

Bahama Banks.

14. ANASIMUS LATUS *Rathbun.* Pl. II, Figs. 2–5.

Stations 26 and 47, off Key West, 60 to 80 fathoms.

15. ANAMATHIA CRASSA (*A. Milne Edwards*). Pl. I.

Station 33, off Sand Key, about 105 fathoms; stations 52, 62 and 63, off American Shoal, 70 to 110 fathoms; station 56, Pourtales Plateau, about 200 fathoms.

The specimen figured, from station 62, is the largest ever collected. It is covered with stalked cirripeds and exhibits an extraordinary development of the chelipeds. The length of the carapace measured to the base of the rostral horns is 95 mm.; width of carapace, 79.5 mm.; length of cheliped extended, about 39.4 cm. or 15½ inches; entire width of crab with chelipeds extended, about 83.6 cm. or 33 inches; length of merus of cheliped, 17.5 cm.; length of propodus of cheliped, measured on upper margin, 16.2 cm.; length of same, measured on lower margin, 20.6 cm.

16 ANAMATHIA HYSTRIX (*Stimpson*).

Station 56, Pourtales Plateau, about 200 fathoms.

17. ANAMATHIA TANNERI *Smith.*

Station 35, off Key West, 90 fathoms; station 62, off American Shoal, 70 to 80 fathoms.

18. DORYNCHUS THOMSONI *Norman* (=LISPOGNATHUS FURCILLATUS *A. Milne Edwards*).

Station 56, Pourtales Plateau, about 200 fathoms.

19. CHORINUS HEROS (*Herbst*).

Sand Key Light, rocks, sponges, etc.

20. ANOMALOTHIR FURCILLATUS (*Stimpson*).

Station 34, off Sand Key, about 120 fathoms; station 51, off American Shoal, about 100 fathoms.

21. EPIALTUS BITUBERCULATUS *Milne Edwards.*

Harbor Island, Bahamas.

22. ACANTHONYX PETIVERII *Milne Edwards.*

Harbor Island, Bahamas.

23. PYROMAIA CUSPIDATA *Stimpson.*

Station 27, off Key West, 50 to 60 fathoms; station 56, Pourtales Plateau, lat. 24° 16′ N., long. 81° 22′ W., about 200 fathoms.

24. TYCHE EMARGINATA (*White*).

Station 46, off Key West, shallow water; station 68, off Little Cat Island, Bahamas, on the submerged bank connecting it with Eleuthera, 3 to 13 fathoms.

25. PELIA MUTICA (*Gibbes*).

Station 44, off Key West, 5¼ fathoms; off Havana.

The male from off Havana is large, 16 mm. long, with strongly developed chelipeds. In both male and female the carapace is marked with patches of bright red, the ambulatory legs are banded with the same color, and the chelipeds are spotted with a lighter shade. The rostral horns are contiguous for one-half their length, divergent for their distal half. Basal antennal joint without a spine.

26. TEMNONOTUS SIMPLEX *A. Milne Edwards.*

Off Havana; one male.

The carapace is that of typical *simplex*; the basal antennal joint bears two long spines. The species is perhaps identical with *T. granulosus* A. Milne Edwards.

27. LISSA BICARINATA *Aurivillius.* Kongl. Sv. Vet. Akad. Hand., Bd. 23, No. 4, 54, 1889.

Bahama Banks.

Lissa bicarinata was very briefly described from the island of St. Bartholomew.

The following description of an ovigerous female taken by the University Expedition has been compared with the type in the Museum at Stockholm by Dr. Aurivillius who assures me of their identity.

Carapace with two rounded median prominences, one gastric and one cardiac, the former much larger and higher. From the gastric prominence two ridges run divergently backward to the postero-lateral angles of the carapace. Both the median prominences and the ridges are indistinctly tuberculate. The posterior outline is arcuate and is separated from the blunt postero-lateral angles by a broad rounded sinus. The sides of the branchial and gastric regions are steep. Outer margin of the branchial region with a broad and shallow tooth at its middle. Outer margins of the hepatic regions almost parallel. Rostrum proportionally larger than in *L. chiragra*, deflexed, subtruncate, widening at the extremity which is four-lobed, the median lobes rounded and separated by a narrow U-shaped fissure; outer lobes smaller, blunt, slightly less advanced than the median. Upper surface of rostrum slightly concave in a longitudinal direction. There is a short, acuminate præorbital spine directed obliquely upward. The legs are furnished with triangular laminate crests of quite different appearance from the knobby protuberances of *L. chiragra*.

Dimensions.—Length, 8.8 mm.; width, 8; length of rostrum from base of præorbital sinus, 2.3.

28. STENOCIONOPS FURCATA CÆLATA (*A. Milne Edwards*) (=PERICERA CÆLATA *A. Milne Edwards.*)

Stations 24, 44, 45 and 46, off Key West, shallow water to 60 fathoms; Tortugas.

29. STENOCIONOPS SPINOSISSIMA (*Saussure*). Type examined (=PERICERA ATLANTICA *Rathbun*).

Station 24, off Key West, 60 fathoms; station 28, off Sand Key, 116 fathoms; station 39, off Key West, 20 fathoms.

30. MACROCŒLOMA TRISPINOSUM (*Latreille*).

Station 45, off Key West, shallow water; Dry Tortugas; Bahia Honda, Cuba; Bahama Banks; Egg Island, Bahamas.

31. MACROCŒLOMA CAMPTOCERUM (*Stimpson*).

Stations 44 and 46, off Key West, 5¼ fathoms.

One male has unusually long rostral horns, over one-third the entire length of the carapace.

32. MACROCŒLOMA DIPLACANTHUM (*Stimpson*).

Station 68, off Little Cat Island, Bahamas, on the submerged bank connecting it with Eleuthera, 3 to 13 fathoms.

33. MACROCŒLOMA SEPTEMSPINOSUM (*Stimpson*).

Stations 24 and 27, off Key West, 50 to 60 fathoms; station 28, off Sand Key, 116 fathoms; Bahama Banks.

34. MACROCŒLOMA EUTHECA (*Stimpson*).

Station 24, off Key West, 60 fathoms; one male: off Havana, one young male; Bahama Banks, one male, one young female.

These specimens I believe to be Stimpson's *Pericera eutheca*. In the largest male, from station 24, the rostral horns are slender, parallel for one-half their length, with a U-shaped interspace, tips slightly divergent. The orbital sheath is prolonged far beyond the outer spine of the basal antennal joint, and is tipped with three spines, one antero-superior, one postero-inferior, the other postero-superior and situated just in front of the superior closed sinus; in the "Albatross" specimens (Proc. U. S. Nat. Mus., 1892, 251), the sheath is shorter, projecting but little beyond the outer antennal spine, and exclusive of the latter, is armed with four spines, one antero-superior, one postero-inferior, one inferior, and the fourth superior and behind the closed sinus. The carapace is very narrow behind the orbits. The gastric, cardiac, and intestinal prominences are spines. There is a spinule at the summit of the branchial region and one strong spine at the lateral margin which is inserted in a transverse line with the cardiac spine.

Dimensions.—Entire length, 27; length from between rostral horns, 24; greatest width at orbits, 15.2; greatest branchial width, 23; branchial width, without spines, 18; antero-lateral width at narrowest point, 10 mm.

A specimen about one-half the size of the above was dredged on the Bahama Banks. The horns are more nearly parallel throughout their length, The orbital width equals the branchial width exclusive of spines. Branchial spines more slender than in the above.

These specimens are specifically distinct from those which I referred in 1872 provisionally to *M. eutheca*. These last are possibly a variety of *M. concavum* Miers.

35. MICROPHRYS BICORNUTUS (*Latreille*).

Stations 45 and 46, off Key West, shallow water; Dry Tortugas, Harbor Island, Egg Island and Spanish Wells, Bahamas; Bahama Banks.

36. PITHO ACULEATA (*Gibbes*) (=OTHONIA ACULEATA of authors).

Tortugas, shallow water in gulf weed; Spanish Wells, Bahamas.

37. PITHO ANISODON (*von Martens*) (=OTHONIA LHERMINIERI *Rathbun* not *Schramm*).

Station 44, off Key West, 5¼ fathoms.

38. PITHO LHERMINIERI (*Schramm*) (=OTHONIA CAROLINENSIS *Rathbun*).

Station 46, off Key West, shallow water; Bahama Banks.

39. PITHO MIRABILIS (*Herbst.*).

Bahama Banks.

Among the Herbstian types in the Berlin Museum are three carapaces labeled "*Cancer mirabilis*" by Herbst. They are not, however, all the same species, the larger being nearly smooth with five large, entire, acute and widely divergent teeth, the two smaller having a granulated carapace and five subacute teeth with denticulated margins and diminishing in size from the anterior to the posterior. The first of these species was described in 1875 by A. Milne Edwards under the name *Othonia lævigata* from the Antilles; the second by myself in 1892 as *O. rotunda*, from Key West, Florida. The name *mirabilis* belongs properly to the latter of the two species, not only by the law of elimination but for the reason that Herbst figured a specimen of this species, as denoted by the granulated carapace and somewhat appressed teeth. His description too is more applicable to this species; although founded on both, for he says that the teeth are sometimes sharply pointed, sometimes more rounded. The types of *Cancer mirabilis* were assumed by Gerstæcker in 1856 to be all the same species, of which *O. sexdentata* Bell and *O. quinquedentata* Bell were supposed to be synonyms.

40. MITHRAX (NEMAUSA) ACUTICORNIS (*Stimpson*) (=NEMAUSA ROSTRATA *A. Milne Edwards;* types examined).

Station 24, off Key West, 60 fathoms; off Havana.

41. MITHRAX SPINOSISSIMUS (*Lamarck*).

Bahama Banks.

42. MITHRAX VERRUCOSUS *Milne Edwards*, variety (=M. ACULEATUS *Rathbun* not *Herbst* nor *Milne Edwards*).

Dry Tortugas.

43. MITHRAX HISPIDUS (*Herbst*).

Stations 44, 45 and 46, off Key West, shallow water; Tortugas.

44. MITHRAX HOLDERI *Stimpson*. Bull. Mus. Comp. Zoöl., II, 117, 1871. Pl. III, Fig. 2.

Tortugas; 7 fathoms.

The specimens of this species known to Stimpson are not extant. I refer to it a single ovigerous female taken off Havana.

Carapace oblong, covered with unequal, prominent tubercles, and with large crowded punctæ. Frontal horns depressed, short, acute, nearly horizontal. Basal antennal joint with three spines, the antero-external long, nearly as advanced as the rostrum, and directed obliquely upward and outward; posterior spine small; a third spine or sharp tooth is at the base of the flagellum. Orbital teeth and spines five, exclusive of the antennal; præorbital longest and curved inward. Antero-lateral margin with two prominent spines, one hepatic, and the other at the branchial angle; between them are two clusters of tubercles; in front of and behind the branchial spine there is a small spine or spinule. Inferior regions of the carapace covered with tubercles which become spinulous on the sub-hepatic region. Chelipeds with meri armed with stout blunt spines above; hands unarmed. Ambulatory legs flattened above and hairy; meral and carpal joints armed with two rows of spines.

Dimensions.—Entire length of carapace, 21.5; length to base of rostral horns, 20; entire width, 21.2; width without spines, 18.4; exorbital width, 12.3 mm.

Specimens agreeing with the above and taken at St. Croix and St. John, West Indies, are in the Museum at Copenhagen. One immature female has been presented to the United States National Museum.

45. MITHRAX FORCEPS (*A. Milne Edwards*).

Stations 45 and 46, off Key West, shallow water; Tortugas; Spanish Wells; Bahama Banks.

46. MITHRAX SCULPTUS (*Lamarck*).

Tortugas, shallow water; Harbor Island and Spanish Wells, Bahamas.

47. MITHRAX CORONATUS (*Herbst*).

Sand Key Light, in rocks, sponges, etc.; Tortugas; Egg Island and Harbor Island, Bahamas.

One male from the Tortugas is of unusual size, measuring in length 21.3 mm.; width, 27.7; length of propodus of cheliped, 22.8; depth of same, 11; thickness, 6.7 mm.

48. THOE PUELLA *Stimpson.*

Tortugas.

PARTHENOPIDÆ.

49. LAMBRUS POURTALESII *Stimpson.*

Stations 24 and 47, off Key West, 60 to 80 fathoms; stations

41 and 42, off Sand Key, 15 fathoms; Pourtales Plateau; off Havana.

50. LAMBRUS FRATERCULUS *Stimpson.*

Stations 24 and 26, off Key West, 60 fathoms.

51. LAMBRUS AGONUS *Stimpson.*

Stations 24 and 26, off Key West, 60 fathoms.

52. LAMBRUS CRISTATIPES (*A. Milne Edwards*) (=MESORHŒA CRISTATIPES *A. Milne Edwards*).

Station 56, Pourtales Plateau, lat. 24° 16′ N., long. 81° 22′ W., about 200 fathoms.

53. PLATYLAMBRUS SERRATUS (*Milne Edwards*).

Stations 45, 66 and 67, off Key West, shallow water; Tortugas; Bahia Honda, Cuba.

54. SOLENOLAMBRUS TYPICUS *Stimpson.*

Stations 27 and 47, off Key West, 50 to 80 fathoms.

55. SOLENOLAMBRUS TENELLUS *Stimpson* (=PISOLAMBRUS NITIDUS *A. Milne Edwards*).

Stations 24 and 27, off Key West, 50 to 60 fathoms.

56. CRYPTOPODIA CONCAVA *Stimpson.*

Station 39, off Key West, 20 fathoms; Bahama Banks.

57. THYROLAMBRUS ASTROIDES *Rathbun.*

Thyrolambrus astroides Rathbun, Proc. U. S. Nat. Mus. XVII, No. 986, 83, 1894. Nutting, Bull. Labor. Nat. Hist. State Univ. Iowa, III, 77, Pl. facing p. 76, Fig. 2 (♂), 1895.

Parthenope (*Parthenomerus*) *efflorescens* Alcock, Jour. Asiatic Soc. Bengal, LXIV, pt. II, No. 2, 281, 1895.

Parthenope efflorescens Alcock, Illus. Zoöl. "Investigator," Crustacea, Part IV, Pl. XXII, Figs. 5, 5a (♀), 1896.

This species was founded on three specimens, a male and two females, dredged by the "Albatross" off Havana in 67 and 189 fathoms. In the United States National Museum there is a male from Mauritius which differs only in its greater size from the West Indian form, and confirms the belief that the species is identical with *Parthenope* (*Parthenomerus*) *efflorescens* Alcock, from the Andaman Sea, 36 fathoms. Two males were taken by the University Expedition, off Havana.

CANCRIDÆ.

58. CARPILIUS CORALLINUS (*Herbst*).
Spanish Wells, Bahamas.

59. LIOMERA LONGIMANUS *A. Milne Edwards*.
Tortugas.

60. ACTÆA SETIGERA (*Milne Edwards*).
Tortugas.

ACTÆA BIFRONS sp. nov. Pl. IV, Figs 3 and 4.

Allied to A. setigera; *front double; fingers smooth.*

Carapace narrower and flatter than in *setigera;* areolations similar, granulation finer, marginal lobes more angular. Front (Fig. 3), with a double edge, the inferior slightly in advance of the superior, but scarcely noticeable in a dorsal view; the two lobes of the superior margin are slightly arcuate, margin denticulate or granulate; the lower margin viewed from in front is sinuous; surface between the two margins, concave. The epigastric region is coarsely granulate. Eyes larger than in *setigera;* inferior orbital margin with a prominent tooth at the inner angle. The chelipeds differ from those of *setigera* in having the fingers longer in proportion to the palm, more strongly bent downward, the pollex wider at base than the dactylus. The fingers are horn-color and are almost smooth, being marked with lines of shallow pits; in *setigera*, on the contrary, the grooves on the fingers are very deep and the intervening ridges are narrow and armed with conical tubercles. The hairs which cover the surface are dark-brown; in *setigera*, yellow.

Dimensions.—Male, length 5.5, width 8 mm.

Type locality.—Off Aspinwall, lat. 9° 32′ 20″ N., long. 79° 54′ 45″ W., 34 fathoms, station 2147, United States Fish Commission Steamer "Albatross" (U. S. Nat. Mus. No. 7803).

61. ACTÆA RUFOPUNCTATA NODOSA (*Stimpson.*)

Tortugas.

62. ACTÆA PALMERI *Rathbun.*

Bahama Banks.

63. CARPOPORUS PAPULOSUS *Stimpson.*

Station 24, off Key West, 60 fathoms.

64. PILUMNOIDES NUDIFRONS (*Stimpson*).

Station 29, off Sand Key, about 116 fathoms; station 30, off Key West, about 100 fathoms; station 62, off American Shoal, 70 to 80 fathoms.

The male from station 30 is considerably larger than the type, measuring 14.8 mm. long, and 17.4 mm. wide.

Genus PILUMNUS *Leach.*

SYNOPSIS OF AMERICAN SPECIES.[1]

- A. Carapace for the most part concealed by a short thick pubescence, which when removed discloses tubercles on the gastric and hepatic regions.
  - B. Frontal lobes concave, entire. *reticulatus* Stimpson =*tessellatus* A. Milne Edwards
  - B′. Frontal lobes convex, granulate or denticulate.
    - C. Entire outer surface of palms tuberculate.
      - D. Lower margin of orbit granulate, with no teeth excepting at the inner angle. *gemmatus* Stimpson
      - D′. Lower margin of orbit with three or four irregular granulated teeth. *limosus* Smith
    - C′. Outer surface of palms partially smooth and naked.
      - D. Antero-lateral projections, after the pubescence is removed, spiniform, curved, sharp. *pannosus* Rathbun =*gemmatus* A. Milne Edwards
      - D′. Antero-lateral projections, after the pubescence is removed, dentiform, short, obtuse. *holosericus* Rathbun
- A′. Carapace, when covered by a short thick pubescence, not having the gastric region tuberculate.
  - B. Superior orbital border with one or few long spines.
    - C. Outer surface of larger hand partially smooth and naked.

---

[1] *Pilumnus nudifrons* Stimpson is a *Pilumnoides;* see No. 64.

D. No subhepatic spine. *spinosissimus* Rathbun

D′. A subhepatic spine.

E. Superhepatic region unarmed. *spinohirsutus* Lockington

E′. Superhepatic region armed with spines or spinules.

F. Front and orbits with a few long spines. *sayi* Rathbun
=*aculeatus* (Say)

F′. Front and orbits spinulous but without long spines.
caribæus Desbonne & Schramm

C′. Outer surface of larger hand all over spinulous.

D. Carapace covered with long, fine, silky hair. *diomedeæ* Rathbun

D′. Carapace not covered with long, fine, silky hair.
gracilipes A. Milne Edwards

B′. Superior orbital border either entire or armed with denticles or spinules.

C. Outer surface of larger hand entirely smooth and naked.
andrewsii Rathbun

C′. Outer surface of larger hand not entirely smooth and naked.

D. Outer surface of larger hand only partially covered with tubercles or spines.

E. Outer surface of smaller hand only partially covered with tubercles or spines.

F. Carapace and chelipeds furnished with mushroom-like tubercles. *fragosus* A. Milne Edwards

F′. Carapace and chelipeds not furnished with mushroom-like tubercles.

G. Antero-lateral spines or teeth 5, including orbital.
spinipes (A. Milne Edwards as *Micropanope*)

G′. Antero-lateral spines or teeth 4, including orbital.
lacteus Stimpson

E.′ Outer surface of smaller hand entirely covered with tubercles or spines.

F. Carapace covered with hair.

G. Frontal lobes separated from remainder of carapace by a fringe of hair. *floridanus* Stimpson
=*lacteus* A. Milne Edwards

G′. Frontal lobes not separated from remainder of carapace.

H. Carapace rough on the hepatic region.
gonzalensis Rathbun

H . Carapace smooth.

J. Antero-lateral spines 4 including postorbital.
quoyi Milne Edwards

J. Antero-lateral spines 5, including postorbital.
miersii A. Milne Edwards

F′. Carapace naked on posterior half.
  G. Second lateral tooth simple. *dasypodus* Kingsley =*vinaceus* A. Milne Edwards
  G′. Second lateral tooth bifid. *depressus* Stimpson
D′. Outer surface of larger hand entirely covered with tubercles or spines.
  E. Hands armed with blunt tubercles or granules, and no spines. *stimpsonii* Miers =*marginatus* Stimpson
  E.′ Hands armed with sharp spines.
    F. Spines of hands arranged in longitudinal rows. *brasiliensis* Miers
    F′. Spines of hands not in rows.
      G. Ambulatory legs spinous. *urinator* A. Milne Edwards
      G′. Ambulatory legs unarmed. *xantusii* Stimpson

65. PILUMNUS SAYI *Rathbun* (=P. ACULEATUS (*Say.*)).

Tortugas; Egg Island, Bahamas.

66. PILUMNUS CARIBÆUS *Desbonne and Schramm.*

Egg Island; Bahama Banks, from millepores.

67. PILUMNUS FLORIDANUS *Stimpson* (=P. LACTEUS *A. Milne Edwards*, types examined; not Stimpson.)

Bahama Banks.

68. PILUMNUS URINATOR *A. Milne Edwards?*

Station 48, off Key West, about 80 fathoms. One male. I have not seen the type of *P. urinator*. The above specimen agrees with the description and figure of that species excepting that the carapace is somewhat wider. and the front instead of being unarmed is finely denticulate. Specimens with the same characters were collected by the "Albatross" in the Caribbean Sea at station 2131, lat. 19° 56′ 44″ N., long. 75° 50′ 49″ W., 202 fathoms, and station 2135, lat. 19° 55′ 58″ N., long. 75° 47′ 07″ W., 250 fathoms. Length of male, station 2131, 7 mm., width 10 mm.; length of male, station 48, 6.3 mm., width 8.5 mm.

69. PILUMNUS SPINOSISSIMUS sp. nov. Pl. v, Fig. 3.

Station 44, off Key West, 5¼ fathoms.

One male.

Long hairy; frontal lobes oblique; orbits spinous; lateral spines four; chelipeds spinous.

Carapace covered on its anterior half with spiniform granules and a few long hairs; posterior half almost smooth. Front bilobed; lobes separated by a broad U-shaped sinus; each lobe has an oblique margin armed at either end with a short spine; next the inner spine there is a short, shallow sinus, armed with minute spinules; remainder of the front unarmed. Superior orbital margin armed with four long spines, the two innermost curving toward each other. Lateral margin with three long spines besides the orbital, the posterior spine being a little shorter. Lower orbital margin armed with ten small irregular spines. The outermost is separated from the postorbital spine by a deep sinus; the two innermost are situated at the extremity of a prominent suborbital process; the next two are among the largest; the remaining five are very short spines or spiniform teeth.

Chelipeds of the male unequal; merus with two long curved spines at the distal end of the upper margin; carpus armed with about 20 sharp spines curved toward the manus. Larger manus with about seven irregular rows of spines which cover about two-thirds of the outer surface; they are large above and gradually diminish in size downward. On the smaller manus, the spines cover the outer surface,

Dactyli spinulous on the proximal half. Ambulatory legs long and hairy; meri spinulous above; carpi and propodi armed with long spines.

Dimensions.—Length, 8.3 mm.; width, 11.6; width without spines, 10.5.

The character of the front and orbits sufficiently distinguishes this species from all others.

70. PILUMNUS LACTEUS *Stimpson*, not *A. Milne Edwards*.

Tortugas.

PILUMNUS ANDREWSII sp. nov. Pl. V, Fig. 2.

Slightly hairy; front and orbits not spinous; lateral spines and teeth five; outer surface of hands smooth and naked.

Carapace broad: slightly hairy, but not enough to obscure the regions of the carapace: granulate, especially anteriorly and laterally. Frontal lobes subtruncate, sloping slightly backward toward the orbit, separated by a broad notch, margin minutely denticulate. Upper and lower margins of orbit denticulate: at the inner lower angle there is a prominent tooth in line with the frontal lobes. Outer angle of orbit dentiform. There are four additional lateral prominences. The one next the orbit or the second tooth proper is small and dentiform. The third, fourth and fifth are larger, spiniform, with long acuminate tips, that of the third tooth pointing inward, of the fifth pointing outward, and the fourth directed nearly forward. Sub-hepatic tooth present. Inferior surface of carapace granulate and pubescent

The merus of the chelipeds is armed with spines on the upper and inner margins: upper part of outer surface granulate, distal margin of lower surface spinulous. Carpus covered with acute granules or tubercles; two sharp spines at the inner angle, one below the other. Merus and carpus slightly hairy. Manus of larger cheliped wholly smooth and naked on the outer surface: at the proximal end of the superior inner face, along the line of the carpus when the cheliped is bent, there is an irregular line of granules. Dactylus with a large basal tooth. Fingers light horn-color, the color on the pollex running from the middle of the dactylic tooth in a line nearly at right angles with the inferior margin of the manus. Fingers not gaping. Smaller manus smooth and naked except for a few granules at its proximal end, and pointed tubercles along the bicristate upper margin, and on the superior inner surface. Ambulatory legs long and narrow: margins with long, fine hairs, meral joints armed above with slender spines.

Dimensions.—Female, length 8.9, width including spines 12.8 mm.

Type locality.—Green Turtle Cay, Bahamas; Dr. E. A. Andrews collector, 1897; two females (U. S. Nat. Mus. No. 20,508).

71. PILUMNUS GEMMATUS *Stimpson.*

Dry Tortugas.

72. PILUMNUS PANNOSUS *Rathbun* =P. GEMMATUS *A. Milne Edwards* not *Stimpson.*

Bahama Banks, from millepores.

73. PILUMNUS HOLOSERICUS *Rathbun* sp. nov. Pl. v, Fig. 1.

Egg Island, Bahamas; one male.

Densely pubescent; carapace tuberculate; lateral teeth obtuse; large hand partially bare outside.

Allied to *P. gemmatus* Stimpson and *P. pannosus* Rathbun. Carapace more oval than in those species. Surface covered with a short, smooth velvety pubescence which does not conceal the boundaries of the areolations. On either side of the gastric region there is a tuft of long hairs. Antero-lateral teeth shorter than in *gemmatus* or *pannosus* and blunt, even when the pubescence is removed. Tubercles of the carapace and chelipeds smaller and more numerous than in the allied species. Larger hand with the lower and distal portion of the outer surface bare and unarmed, but this space is smaller than in *pannosus.* Fingers shorter than in that species. Smaller hand with entire outer surface pubescent and hairy. Ambulatory legs pubescent and fringed with long hairs.

Dimensions.—Length of male, 6.1; width 8.3 mm.

Distribution.—Type locality, St. Thomas, one male received from the Copenhagen Museum (U. S. Nat. Mus. No. 19,705). A smaller specimen, also a male, was taken at St. Thomas by the "Albatross." A larger specimen, a male, 6.8 mm. long and 9.1 wide, was collected at Egg Island, Bahamas, by the University Expedition. Several specimens are in the Museum at Copenhagen, including one from St. John, West Indies.

This species need not be confused with *pannosus* which has a much more ragged appearance; nor with *gemmatus* which is a considerably longer species and has the entire outer surface of both hands tuberculate.

74. LOBOPILUMNUS AGASSIZII (*Stimpson*) =LOBOPILUMNUS PULCHELLUS *A. Milne Edwards.*

Stations 45 and 46, off Key West, shallow water; Tortugas, dredged.

Of the two forms described by A. Milne Edwards as *L. agassizii* and *L. pulchellus*, it is evident that the first cannot be the one described by Stimpson as *Pilumnus agassizii*, because it has not the "anterior and antero-lateral areolets . . . . . naked and thickly granulated," and the "penult and antepenult joints [of the ambulatory feet] armed with minute spines above." Several lots of *L. agassizii* (Stimpson =*L. pulchellus A. Milne Edwards*) were dredged by the "Albatross" in the Gulf of Mexico and Caribbean Sea, while a large series of *L. agassizii* A. Milne Edwards was collected in Bermuda by Dr. G. Brown Goode in 1876–77. Some of the specimens of the University Expedition are intermediate between the two forms. I propose the name *L. agassizii bermudensis* for the subspecies from Bermuda.

75. HETERACTÆA CERATOPUS (*Stimpson*).

Tortugas.

76. PHYMODIUS MACULATUS *Stimpson.*

Dry Tortugas; Spanish Wells, Bahamas.

REMARKS ON EURYPANOPEUS AND ALLIED GENERA.

If the species already included in the genus *Eurypanopeus* A. Milne Edwards (=*Panopeus* Milne Edwards, name preoccupied) be retained in it, the genus will embrace not only species hitherto referred to *Panopeus*, *Eurytium* and *Eurypanopeus*, but others now included in *Micropanope*, *Neopanope* and *Xanthias* (=*Xanthodes*), which last is closely connected with *Xantho* and *Lophoxanthus* on the one hand and *Leptodius* and *Xanthodius* on the other. It is obvious that no good purpose will be subserved by uniting all these diverse forms. It is not possible to separate any of these genera from all the others by a single character, such as the shape of the finger tips, the presence or absence of a sternal canal for the sexual appendages, or the development of the ridge on the palate.

The modification of the palatal ridge is an important factor in Dr. Ortmann's division of his section B. of the Xanthini. In this section the family Xanthidæ is said to differ from the family Oziidæ only in lacking a ridge on the palate, which in the Oziidæ is either distinct or indistinct. The fact is, that typical species of *Xantho*, such as *X. hydrophilus* Herbst (= *X. incisus* Leach) have a rudimentary ridge on the palate posteriorly developed as in *Eurypanopeus*. In the three species of *Eurypanopeus* so-called, *herbstii*, *occidentalis*, and *americanus* (species so much alike in general appearance that they are not acknowledged by Dr. Ortmann to be distinct), the palatal ridge is stronger than in *Xantho;* it is longest in *herbstii*, of about equal length in *occidentalis* and *americanus*, but better developed in the latter than in *occidentalis*. In *E. texanus* (family Oziidæ Ortmann) the ridge is less developed than in *Xantho hydrophilus*.

For the value of spoon-shaped fingers as a generic character, compare *Eurypanopeus depressus* with *E. abbreviatus*.

In order to express the relationships of the various Xantho-Panopean species I believe it is best to divide them according to their form and general appearance into a number of genera, including the ten above mentioned to which I have assigned in nearly every case different limits from those before ascribed to them. The collection of the University Expedition contains six of these closely related genera of which three are new.

Genus LEPTODIUS *A. Milne Edwards*.

Carapace suboval, wider than in *Xantho*; antero-lateral margin very long, with five well-developed teeth; front and orbits wider than in *Xantho;* frontal and antero-lateral margins not thickened; palatal ridge absent in typical species; ambulatory legs narrower than in *Xantho*. Type, *L. exaratus* (Milne Edwards).

77. LEPTODIUS FLORIDANUS (*Gibbes*).

Tortugas, in gulf weed.

Genus XANTHIAS *Rathbun*, 1897.

(=XANTHODES *Dana*, preoccupied).

Carapace oval or suboval, narrower than in *Leptodius*, areolate, granulate, convex in an antero-posterior direction; front and orbits as wide as in *Leptodius;* basal antennal joint barely touching the projection from the front; lateral teeth usually four (sometimes three) besides the orbital angle, small, subequal. Chelipeds more or less granulate; carpus with a groove next the manus; palms thick; fingers bent down, little or not gaping; ambulatory legs granulate or denticulate above. Type, *X. lamarckii* (Milne Edwards). Here belong of American species *X. taylori* (Stimpson), *sulcatus* (Faxon), *politus* Rathbun (as *Micropanope*), *granulimanus* (Stimpson as *Pilumnus*), and probably also *xantusii* and *insculptus* (Stimpson) and *latus* (Faxon as *Panopeus*).

78. XANTHIAS NUTTINGI *Rathbun* sp. nov. Pl. IV, Fig. 1.

Bahama Banks, from millepores; numerous. Station 46, off Key West, shallow water.

Carapace suboval, convex in an antero-posterior direction, nearly flat in a transverse direction; anterior half rough with scaly granules; regions distinct. Front convex, with two lobes with granulate margins, separated by a V-shaped sinus. Antero-lateral margin with three sharp-pointed teeth besides the orbital, which is obliquely truncate and not prominent: the posterior tooth is the smallest. Margin of orbit and lateral teeth granulate. The outer fissure of the orbit is broad and V-shaped.

Chelipeds heavy, unequal; meri spinulous on upper edge; carpi covered with bead-like tubercles, with a deep anterior groove and a small inner tooth terminating in a spinule. Manus of larger cheliped in male with the upper and about two-thirds the outer surface ornamented with bead tubercles; lower one-third and distal extremity smooth and shining; fingers broad, not gaping, brown with light tips; dactylus with a large basal tooth; color of pollex not running back on the manus, but forming a line with the articulation of the dactylus. Manus of smaller cheliped almost entirely covered with tubercles which grow smaller toward the distal and lower margins; upper margin with a longitudinal groove; fingers deeply grooved. Upper margins of ambulatory legs tuberculate or granulate. The females differ in having the whole outer surface of the larger as well as of the smaller hand tuberculate.

Dimensions.—Length of carapace of male 3.6, width 4.7, length of larger propodus 4, width 2.3 mm.

Color.—Specimens in alcohol are speckled with dark blue, with larger patches on the anterior part of the gastric region and on the cardiac region.

Type locality.—Bahama Banks (University Collection and U. S. Nat. Mus. No. 19975).

Distribution.—Besides having been taken off Key West, this species had previously been dredged by the "Albatross" in the Gulf of Mexico and Caribbean Sea at stations 2362, 2363, 2365 and 2413, in 21 to 25 fathoms, and at Old Providence.

Genus LOPHOPANOPEUS nov.

Carapace hexagonal, convex, areolate; lateral teeth N, T and S (in the language of Dana) subequal, prominent; E present, but reduced and coalesced with D to a greater or less extent; front narrow, lobes sinuous; orbits transverse. Carpus of chelipeds longer than wide; lower margin of propodus concave distally; ambulatory legs more or less cristate. In *Lophoxanthus* A. Milne Edwards (type *Xantho lamellipes* Stimpson) the carapace is flat, the orbits small and circular, the chelipeds heavy.

Type of *Lophopanopeus*, *Xantho bellus* Stimpson. To this genus belong also the species *leucomanus* (Lockington as *Xanthodes*), *japonicus* nom. nov. (=*Lophozozymus* (*Lophoxanthus*), *bellus* var. *leucomanus* Miers), *frontalis* Rathbun (as *Lophozozymus* (*Lophoxanthus*)), *lobipes* (A. Milne Edwards as *Neopanope*), two undescribed species from Western America, and *distinctus*, nom. nov. (=*Micropanope sculptipes* A. Milne Edwards not Stimpson) which is included somewhat doubtfully.

79. Lophopanopeus lobipes (*A. Milne Edwards*).

Bahama Banks: station 46, off Key West, shallow water.

Genus Eupanopeus nom. nov.

(=Panopeus *Milne Edwards*, part.)

Carapace of moderate width, anteriorly subquadrate, crossed by broken transverse lines; frontal lobes sinuous; five distinct lateral teeth; N, T, S prominent; E usually prominent.

Type, *E. herbstii* (Milne Edwards). Includes *occidentalis* (Saussure), *americanus* (Saussure) (=*areolatus* Benedict and Rathbun), *serratus* (Saussure), *chilensis* (Milne Edwards and Lucas) (=*validus* Smith), *rugosus* (A. Milne Edwards), *crassus* (A. Milne Edwards), *purpureus* (Lockington,) *bermudensis* (Benedict and Rathbun) (=*wurdemannii* Benedict and Rathbun, not Gibbes), *convexus* (A. Milne Edwards), *africanus* (A. Milne Edwards), *bradleyi* (Smith) and *harttii* (Smith).

The species *texanus* (Stimpson) (including *texanus sayi*[1] (Smith)) and *packardii* (Kingsley as *Panopeus*.=*Neopanope pourtalesii* A. Milne Edwards) are united under *Neopanope* A. Milne Edwards.

A new genus, Hexapanopeus, is proposed for the narrow, hexagonal species of *Panopeus* with rapidly converging postero-lateral margins. Here belong *angustifrons* (B. & R., type), *hemphillii* (B. & R.) and *caribæus* (Stimpson as *Micropanope*).

The species *Panopeus harrisii* (Gould) (=*wurdemannii* Gibbes not B. & R.) is made the type of a distinct genus Rhithropanopeus (῾Ρειθρον, a river or stream). It is narrow, approaching the Carcinoplacinæ in form, the dorsal ridges are prominent, and the third abdominal segment does not touch the coxæ of the fifth pair of feet.

80. Eupanopeus herbstii (*Milne Edwards*).

Bahama Banks.

---

[1] A series of forms intermediate between *texanus* and *sayi* were collected by the United States Fish Commission at Indian River, Florida, in 1896; the latter form is therefore a geographical variation of the former.

81. EUPANOPEUS OCCIDENTALIS (*Saussure*)?

Tortugas. Two young.

Genus MICROPANOPE *Stimpson.*

Carapace of moderate width, panopeiform; usually granulous or spinulous. Of the antero-lateral teeth, E is reduced or wanting, S is much reduced; antero-lateral margin spinulous; ambulatory legs spinulous on superior or anterior margin in typical species.

Type, *M. sculptipes* Stimpson. To this genus I refer *xanthiformis* (A. Milne Edwards as *Panopeus*), *lobifrons* A. Milne Edwards, *truncatifrons*, sp. nov., an undescribed species from the Pacific coast, and *latimanus* and *cristimanus* Stimpson which I have not seen.

82. MICROPANOPE XANTHIFORMIS (*A. Milne Edwards*).

Station 41, off Sand Key, 15 fathoms; one male.

MICROPANOPE TRUNCATIFRONS sp. nov. Pl. IV, Fig. 2.

Coarsely granulate; frontal lobes truncate.

Carapace moderately convex; antero-lateral teeth horizontal. Surface granulate, granules large and conspicuous anteriorly, diminishing toward the posterior margin. Regions well defined. On each protogastric region there is a short, oblique ridge; a longer ridge on each hepatic region; a transversely arcuate elevation on the anterior part of the branchial region. Outer orbital tooth very small and well separated from the second tooth which is small and tuberculiform. Third, fourth and fifth teeth dentiform, the third directed forward, the fourth and fifth outward, the fifth smaller than the two preceding. Margin of teeth denticulate. Front truncate; margin thin, finely crenulate; lobes under the lens slightly sinuous; a row of coarse granules behind and above the margin giving the front the appearance of having a double edge. Orbital margin granulate; two superior fissures little marked, inferior margin with two subequal teeth and a broad outer V-shaped fissure. Inferior surface of the carapace granulate.

Chelipeds unequal in the female, tuberculate. Merus short and broad, triangulate, armed with rather sharp tubercles, larger on the margins. Tubercles of the carpus forming irregular masses and ridges; two inner spines of which the inferior posterior is the smaller. Manus with a superior groove and double crest; tubercles of the outer face diminishing in size towards the lower margin; those of the inner face very large near the upper margin, diminishing toward the lower and distal margins. Larger hand stout, palmar portion convex above and below; smaller hand with margins subparallel. Fingers brown, deeply grooved, finely granulate, not gaping when closed; dactylus of larger hand with larger basal tooth. Ambulatory legs very slender, granulate: meri armed with small spines anteriorly; carpal and propodal joints with spinules.

Dimensions.—Length 7, width 10.4, exorbital width 6.5, width of front 3.5 mm.

Type locality.—Off Havana, Cuba, lat. 23° 11′ 45″ N., long. 82° 18′ 54″ W., 194 fathoms, station 2326, one female (U. S. Nat. Mus. No. 9497).

Additional localities.—Off Havana, lat. 23° 10′ 40″ N., long. 82 °20′ 15″ W., 182 fathoms, station 2349, one small male. Off Arrowsmith Bank, Yucatan, lat. 20° 59′ 30″ N., long. 86° 23′ 45″ W., 130 fathoms, station 2354, one female.

83. MICROPANOPE LOBIFRONS *A. Milne Edwards.*

Off Havana, one female.

Genus TETRAXANTHUS nov.

Carapace quadrate, very convex, not areolate; orbit as wide as half the front; lateral teeth four including the orbital angle; teeth little projecting; first and second small, separated by a shallow sinus; third and fourth somewhat dentiform, obtuse: palate with a ridge. Chelipeds with merus extending considerably beyond the carapace; propodus very concave on lower margin; ambulatory legs long and slender. Type, *T. bidentatus* (A. Milne Edwards as *Xanthodes*).

84. TETRAXANTHUS BIDENTATUS (*A. Milne Edwards*).

Station 42, off Sand Key, 15 fathoms.

85. ERIPHIA GONAGRA (*Fabricius*).

Spanish Wells and Harbor Island, Bahamas.

86. DOMECIA HISPIDA *Souleyet* (=PILUMNUS MELANACANTHUS *Kingsley*=EUPILUMNUS WEBSTERI *Kingsley*).

Sand Key Light, among sponges and rocks.

PORTUNIDÆ.

87. PORTUNUS SAYI (*Gibbes*).

Tortugas, in gulf weed.

88. PORTUNUS (ACHELOUS) SPINIMANUS (*Latreille*).

Stations 44 and 46, off Key West, shallow water; Tortugas, in gulf weed; Bahama Banks.

89. PORTUNUS (ACHELOUS) DEPRESSIFRONS (*Stimpson*).

Station 46, off Key West; Tortugas, dredged; Spanish Wells, Bahamas; Bahama Banks, from millepores.

90. PORTUNUS (ACHELOUS) ORDWAYI *Stimpson*.

Tortugas, gulf weed; Bahama Banks. Two young.

91. PORTUNUS (ACHELOUS) SPINICARPUS *Stimpson*.

Station 24, off Key West, 60 fathoms; station 46, off Key West, shallow water; Tortugas, dredged.

92. CALLINECTES DANÆ *Smith*.

Bahia Honda, Cuba.

One large male. This locality extended the northern limit of the species. The United States Fish Commission has, however, since (in 1896) taken it at Indian River Inlet, Florida.

93. BATHYNECTES SUPERBA (*Costa*) (=B. LONGISPINA *Stimpson*, fide Norman, Ann. Mag. N. H. March, 1891, 272).

Stations 30 and 35, off Key West, 90 and 100 fathoms.

CORYSTIDÆ.

HYPOPELTARIUM DEXTRUM sp. nov. Pl. VI, Fig. 2.

Carapace oval; median tooth of front longer than the lateral: chelipeds very unequal: seven abdominal segments in the male distinct.

This species resembles *H. spinulosum* in the shape of the carapace and lateral lobes, the character of the rostrum, orbits, antennæ and maxillipeds. It differs from it in its very unequal chelipeds and in the separation of the seven abdominal segments. In these points it resembles *Trichopeltarion.*

Carapace narrow, oval, broader anteriorly than posteriorly, very convex, strongly deflexed anteriorly. Surface ornamented with numerous small, white, bead-like tubercles which posteriorly become subacute or spiniform. The surface between the tubercles is covered with very short light-colored setæ. Branchio-cardiac sutures very deep. Front horizontal, tridentate, median tooth twice as long as the lateral, each tooth tipped with a sharp spine, and with two or more smaller spines near the tip. Orbit four-toothed as in *H. spinulosum*, the teeth margined with small spines. Eye-stalks slender, curved, capable of being concealed within the orbits. Eyes imperfectly developed, light brown. About one-third the distance from the tip on the anterior surface there is a small slender spine.

On the lateral margins of the carapace, three shallow teeth or lobes can be made out, two of which are antero-lateral and one postero-lateral; they are bordered by small spines. Inferior surface of the carapace spinulous. The sutures between the abdominal segments are distinct. The terminal segment is not deeply inserted in the preceding segment as in *H. spinulosum*, and is considerably broader than long. The median third of the abdomen is spinulous, the spinules diminishing in size from the first to the sixth segment. Sternum granulate. Antenna with basal joint stout, spinulous, partially movable, and attaining the end of the subocular tooth, second and third joints successively much more slender. The maxillipeds are very similar to those of *H. spinulosum.* Surface partially granulate. The ischium at its distal extremity is wider than the merus; its antero-lateral angle is produced. The merus is narrow at base, its outer margin is arcuate, antero-internal margin oblique; inner angle spinulous.

The chelipeds are very unequal, the right the larger; surface finely granulate. Merus very thick, trigonal, spinulous on upper and outer margins and toward distal end. Carpus with outer surface tuberculous, inner margin thick, armed with sharp spinules; inner angle prominent, quadrate. Manus very deep distally; upper surface spinulous and tuberculous; pollex short, triangular, edged with eight small rounded teeth. Dactylus wide, upper margin arcuate, spinulous; inner edge with five crenate teeth larger than those on the pollex. The fingers are gaping and resemble the beak of a parrot. The smaller cheliped is very spinulous, the upper margin spinous, the fingers proportionally longer and more slender, gaping slightly at base. Ambulatory legs with merus joints spinous on upper margin and in last pair spinulous on outer surface. Carpal joints spinulous in first three pairs. Dactyli very long and slender. The ambulatory legs are fringed with long silky hair, also the upper margin of smaller cheliped, the lower margin of the carapace, the margins of abdomen, sternum and maxillipeds.

Dimensions.—Length 42.5, width 36.5, length of cheliped 72, greatest depth of manus 22, length of lower margin of manus 36, length of smaller cheliped 37.5, length of dactylus of first ambulatory leg on left side 14.5, same on right side 15.7 mm.

Type locality.—Off Cozumel, Yucatan, 231 fathoms, station 2359, steamer "Albatross," one male (U. S. Nat. Mus. No. 9558).

TRACHYCARCINUS SPINULIFER sp. nov. Pl. VI, Fig. 1.

Protuberances of the carapace small and spinulous; chelipeds subequal; outer surface of hands rough.

Shape of the carapace much as in *T. corallinus;* antero-lateral margins more convex. Surface covered with a light-colored pubescence, finer and less dense than in *T. corallinus*. Regions of the carapace well-marked. Elevations smaller, more numerous and less striking than in *T. corallinus*, and covered with small conical tubercles, many of which are spiniform. Slender spinules are scattered on the carapace, especially on the posterior half and near the lateral margins. Lateral spines longer and more slender than in *T. corallinus*, and armed with spinules. Antero-lateral spines three, the third the longest. Postero-lateral spines two. Posterior margin armed with small spines. Front with three slender spines of equal width at base, directed forward, tips broken off. Orbital spines very slender, spinuliferous, the preocular having a small spine at its base on the outer side. The segments of the abdomen in the male are all distinct; the first and second have a few small spines or spinules.

Chelipeds small and nearly equal, the right the larger; covered with slender setæ like those on the carapace. Merus not exceeding the carapace; lower and outer margin spinulous. Outer surface of carpus and manus spinulous, with larger spines at the inner angle of the carpus and along the superior margin of the manus. Ambulatory legs longer and more slender than in *T. corallinus*, pubescent; all the joints excepting the dactyli bear spinules.

Dimensions.— Male, length to base of rostral spines 26, width including spines 34, width excluding spines 23.3 mm. A broken carapace from station 2395 is considerably larger than the type. It measures 40.6 mm. in length to the base of the rostral spines and 38.6 in width exclusive of spines.

Habitat.—Gulf of Mexico, 324 and 347 fathoms, stations 2376 and 2395, steamer "Albatross."

Type locality.—Station 2376, off the Delta of the Mississippi, 324 fathoms (U. S. Nat. Mus. No. 9639).

This species differs from the type of the genus in the same manner that the two species of *Hypopeltarium* differ from each other, that is, in the relative size of the chelipeds and in the distinctness of the seven abdominal segments in the male.

GECARCINIDÆ.

94. GECARCINUS LATERALIS (*Fréminville*).

Tortugas.

95. CARDISOMA GUANHUMI *Latreille.*

Spanish Wells, Bahamas.

PALICIDÆ.

96. PALICUS DENTATUS (*A. Milne Edwards*).

Station 41, off Sand Key, 15 fathoms.

97. PALICUS BAHAMENSIS *Rathbun.* Pl. IX, Fig. 2.

Bahama Banks.

The specimens collected by the University Expedition differ from the type in the shorter and blunt lateral teeth, in the less prominent posterior ridge, in the coarser and more even granulation of the carapace, and the thicker and blunter denticles of the anterior margin of the meral joints of the legs. These denticles, however, have a tendency to become sharp and curved at the tip in some specimens. In spite of these differences I refer these specimens to *bahamensis* on account of the similarity in general characters, the shape of the front and orbits, the arrangement of abdominal and sternal plates, the shape of the chelipeds and ambulatory legs. Chelipeds of small specimens agree with those of the type which is similar in size. In large specimens the chelipeds of the male are more unequal; manus very deep, coarsely granulate, upper surface tuberculate, lower margin nearly straight. Pollex longer and dactylus less deflexed than in the first form of the male of *P. alternatus.* Left cheliped very weak, fingers slender, deflexed. Chelipeds of female similar to the left cheliped in the male. A female of the form above described was taken by the "Blake" off Barbados.

Dimensions.—Male, length of carapace 8, width 9, length of second ambulatory leg 18, length of merus of same 5.2, carpus 3.2, propodus 4.3, dactylus 4.3. Female, length of carapace 7.5, width 8.8 mm. Small specimens are proportionally wider than large.

98. PALICUS ALTERNATUS *Rathbun.*

Station 24, off Key West, 60 fathoms.

99. PALICUS SICA (*A. Milne Edwards*).

Station 41, off Sand Key, 15 fathoms.

OCYPODIDÆ.

100. SPEOCARCINUS CAROLINENSIS *Stimpson.*

Tortugas, dredged.

Three small males. Described by Stimpson from the harbor at Charleston, South Carolina. It has not since been recorded.

101. PRIONOPLAX ATLANTICUS *Kendall.*

Tortugas, dredged.

One ovigerous female, 9 mm. long, 13.5 wide. Only the male of this species was known hitherto. In the type, male, the third, fourth and fifth segments of the abdomen are completely anchylosed.

102. EUCRATOPSIS ELATA (*A. Milne Edwards*)?

Eucratoplax elata A. Milne Edwards, Bull. Mus. Comp. Zoöl., VIII, 18, 1880.

Station 27, off Sand Key, 50 to 60 fathoms.

The typical species of *Eucratoplax* A. Milne Edwards, *E. guttata*, is identical with *Eucratopsis crassimanus* (Dana); therefore *Eucratoplax* becomes a synonym of *Eucratopsis*. The specimens in hand are, I think, referable to the second species of Milne Edwards, *Eucratoplax elata*, which is here assigned only provisionally to the genus *Eucratopsis*, as it differs from the type species of the genus in having the third segment of the abdomen of the male extend to the coxæ of the fifth pair of feet.

Eucratopsis elata is known only from a brief diagnosis of the female. Following is a description of specimens of both sexes in the United States National Museum:

Male.—Carapace subquadrate, convex, punctate, granulate on the branchial, hepatic and intestinal regions; regions well marked. Front deflexed, about two-fifths the width of the carapace; margin thin, divided into two very slightly convex, entire lobes. Orbit nearly as wide as half the front, with two short, closed fissures above and a large outer notch; edge granulate; outer angle obtuse, not prominent; upper margin nearly transverse. Antero-lateral margin shorter than the postero-lateral. Lateral teeth four besides the orbital; the first small, triangular; the second, the broadest; the third the longest and most prominent, acuminate; the fourth postero-lateral, minute. Second segment of abdomen much narrower than the first and third, exposing the sternum; third segment with angular margins; third, fourth and fifth segments coalesced; terminal segment with extremity rounded; proximal margin concave. Surface of abdomen smooth, of sternum granulate.

Chelipeds unequal; granulate; merus trigonal, thick, upper margin with a spine one-third the distance from the proximal end. Carpus with an anterior groove, and sharp inner spine. Granulation of the smaller propodus coarser than that of the larger; in both there is a tendency to form longitudinal ridges. There is a broad truncate tooth on the propodus at the base of the dactylus in both chelæ; in the larger, the dactylus has a large basal tooth; both fingers deeply grooved; pollex with a granulate ridge above the lower margin; dactylus with proximal portion of upper surface granulate. The brown color of the dactylus does not extend quite to the manus; the color of the pollex is even less extensive. Fingers not gaping. Ambulatory legs slender; superior margin of meral, carpal and propodal joints minutely spinulous.

One male was dredged at station 2644, steamer "Albatross," off Cape Florida, lat. 25° 40′ N., long. 80° W., 193 fathoms (U. S. Nat. Mus. No. 11407).

Female.—At stations 2400 and 2401, southwest of Cape San Blas, Florida, 142 and 169 fathoms, were taken one female each, which I refer provisionally to the same species as the above. They differ from the male as follows: The postero-lateral margins are less convergent, and the lateral teeth are three in number, besides the postorbital. The tooth corresponding to the first one of the male is obsolete: the next two are large and less divergent from the carapace than in the male. The last tooth is larger in the female than in the male. The inequality in the chelipeds is less in the female than in the male.

Young.—The young of this or of a closely allied species was taken at station 2402, "Albatross," south of Cape San Blas, 111 fathoms, and by the University Expedition off Sand Key. In these young specimens, only two lateral teeth are evident on the carapace; they are sharp and subequal. There is a denticulated elevation on the merus in place of the single spine of the adult.

Dimensions.—Male, length 7.6, width 10.5, width of front 4.1 mm. Female, station 2401, length 8.1, width 10.2; station 2400, length 6.1, width 7.8 mm.

103. PILUMNOPLAX AMERICANUS sp. nov. Pl. VII, Figs. 1 and 2.

Station 28, off Sand Key, 116 fathoms; stations 51, 52, 62, off American Shoal, 70 to 110 fathoms; station 56, Pourtales Plateau, lat. 24° 16′ N., long. 81° 22′ W., about 200 fathoms.

Surface granulate(?) lateral teeth five; front sulcate.

Carapace finely granulate under the lens; gastro-cardiac sulcus distinct; anterior mesogastric region faintly outlined. Front abruptly deflexed; upper margin with a slight median emargination, from which the two truncate lobes incline slightly backward; surface of front transversely sulcate; lower margin projecting a little beyond the upper, emarginate. Front deepest just outside the median emargination; margins granulate. Superior margin of orbit with a deep and narrow notch near the middle, and a deep rounded sinus near the outer angle. The outer orbital tooth is prominent and blunt, and is coalesced by a shallow sinus with the first broad lobiform tooth of the lateral margin. In addition there are three lateral teeth, of which the first two are acute, the first especially prominent; last tooth very small, indicated only by a feeble emargination. The abdomen covers the sternum at its base. Chelipeds very unequal, everywhere granulated, the granulation of the smaller being coarser than that of the larger. Carpus with two spines at the inner angle.

This species is closely allied to *P. heterochir* (Studer) but differs in the more advanced front and orbital angles, in the additional tooth or lobe of the lateral margin, and in the extensive granulation of the carapace and chelipeds.

Dimensions.—Male, length 7.7, width 9.7 mm. A male from station 62, measures 11 mm. long and 14.2 wide.

Distribution.—The type specimen was taken by the "Albatross" at station 2415, off Georgia, 440 fathoms (U. S. Nat. Mus. No. 19652); also taken by the University Expedition at five stations off the Florida Keys, in from 70 to about 200 fathoms.

Genus CHASMOCARCINUS nov.

(Χάσμη, a gaping; καρκίνος, crab.)

Allied to *Scalopidia* Stimpson. Carapace thick, broadest posteriorly, tapering anteriorly, without antero-lateral angles, the lateral margins forming a curve continuous with the anterior margin. Front narrow, bifid. Orbits marginal, oblong; eyes movable. Pterygostomian region with a horizontal suture as in *Scalopidia.* Antennula with basal joint very large and hemispherical. Epistome nearly perpendicular, its margin projecting below the maxillipeds. Maxillipeds widely separated throughout their length, being placed longitudinally instead of obliquely as in *Scalopidia;* merus suboval, the palpus articulating at the antero-internal angle. Abdomen much narrower at base than the sternum; third, fourth and fifth segments coalesced in the male. The sexual appendages pass to the coxæ through ducts visible between the sternal segments. Abdominal segments distinct in the female. Chelipeds with merus trigonal, carpus quadrate, manus short and broad, fingers long and slender. Ambulatory legs slender, subcylindrical, the third pair the longest, the second next, the fourth the shortest. Dactylus of last pair recurved.

The genus differs from *Scalopidia* chiefly in the form of the merus of the maxillipeds, which is quadrate in that genus, in the character of the epistome which in *Scalopidia* is not sharply separated from the buccal cavity, in the movable eyes which are not concealed beneath the carapace, in the swollen basal joint of the antennula and the cylindrical ambulatory legs.

CHASMOCARCINUS TYPICUS sp. nov. Pl. VII, Figs. 3–5.

Orbits transverse; sternum and abdomen granulate.

Length of carapace a little more than three-fourths of the posterior width. Front and orbits about one-half the width of the carapace. The upper surface is convex and rounds gradually downward into the lateral surfaces which are almost perpendicular. Anterior third strongly deflexed. Lateral margin as seen from above, convex and slightly emarginate at its middle; at this point a deep sulcus arises and extends obliquely downward and forward, joining the inferior horizontal suture. The anterior half of the lateral margin is defined by a slight ridge of fine granules: the posterior half is not defined. The cardiac region is well marked, also the posterior part of the mesogastric. Surface finely granulate. Front with a short and shallow median sulcus; margin transverse, faintly bilobed. Orbit about two-thirds the width of the front; upper margin transverse. Eye fitting closely in the orbit, and much thicker at the base than at the cornea. Below the orbit there is an oblique ridge subparallel to the inferior margin. The margin of the epistome is notched in the middle, on either side of the middle, and again above the summit of the endognath of the maxillipeds. The maxillipeds are separated by a hiatus equal in breadth to the maxilliped. The ischium of the endognath has subparallel sides. The outer margin of the merus is semicircular, the inner margin slightly convex; at its base about half the width of the ischium. The sternum is finely granulate, the abdomen sparsely so. In the male the widest part of the abdomen is at the suture between the third and fourth segments; outline of fourth to seventh segments inclusive, triangular. In the female, the lateral outline of each of the segments from the second to the sixth inclusive, is convex; the general outline from the third to the tip is triangular.

Chelipeds punctate; merus sparsely granulate, longer than wide. In the male the carpus has a tooth at the inner angle, blunt in the larger or right cheliped, acute in the smaller. Palms short and broad, lower margin very convex; fingers very long and slender, strongly bent downward; tips acute and bent toward each other. Dactylus of larger cheliped shorter than the pollex and very thick at base, as seen from above; prehensile margin tuberculate and very hairy. Prehensile margin of pollex denticulate and with a sinus at its base forming a slight gape. Fingers of smaller cheliped slightly bent, not at all gaping, prehensile edges very finely denticulate, with a larger tooth at the base of the dactylus. The chelipeds of the female differ from those of the male in being more nearly equal, the right or larger resembling the left in character, the carpus having a sharp spine, and the fingers very slightly bent and not gaping. Ambulatory legs slightly flattened, hairy; dactyli with a fringe of hair on opposite sides, superior and inferior.

Dimensions.—Male, length 7.5, width 9.8, length of propodus of cheliped 10.5, width of same 4.2, length of pollex along prehensile margin 7, of dactylus along superior margin 7.8 mm.

Type locality.—North of Trinidad, 31 to 34 fathoms, stations 2121 and 2122, U. S. Fish Commission steamer "Albatross" (U. S. Nat. Mus. No. 6901).

CHASMOCARCINUS OBLIQUUS sp. nov. Pl. VII, Fig. 6.

(*Obliquus*, in allusion to the slanting eyes).

Orbits oblique; sternum and abdomen smooth.

Carapace narrower than in *typicus*, without distinct lateral margin. Surface smooth, finely and obscurely punctate. Median notch of front shallow, but more distinct than in *typicus*. Superior margin of orbit oblique. Eyes shorter and less tapering than in *typicus*. Ridge below the orbit less prominent than in *typicus*. Maxillipeds similar. Sternum and abdomen smooth. Abdomen narrower across the third segment than in *typicus;* sixth segment narrower than in that species, and with parallel sides.

Merus of chelipeds with the lower margin spinous; carpus with a long slender spine. Chelipeds nearly equal, in the immature male, fingers slightly deflexed as in the left hand of *typicus*, not gaping, prehensile margins finely denticulate; dactylus of the right cheliped with a basal tooth. Ambulatory legs more slender, less flattened than in *typicus*. The legs are detached. The last two joints have a fringe of long hair.

Dimensions.—Male, length 5.3, width 5.9 mm.

Type locality.—Southeast of Andros Island, Bahamas, in Tongue of Ocean, 97 fathoms, station 2651, "Albatross," one immature male (U. S. Nat. Mus. No. 20509).

104. OCYPODE ARENARIA *Say*.

Tortugas; Loggerhead Key; Egg Island, Bahamas.

105. FREVILLEA BARBATA *A. Milne Edwards*?

Off Havana.

One young male, soft shell, mutilated, about 3 mm. long and 4 wide, is perhaps referable to this species, of which I have seen no examples. The sides of the carapace converge posteriorly. The post-orbital angle is marked by a slender curved spine; behind the spine is one feebly marked tooth. The front is about 1½ mm. wide and is faintly bilobed. Superior orbital margin sinuous, directed obliquely backward to the orbital spine. Eyes very large, as in young *Ocypode*, extending laterally beyond the carapace. The single cheliped (with fingers broken off) is smooth. The carpus has a short inner spine.

FREVILLEA QUADRIDENTATA sp nov. Pl. VIII, Fig. 1.

Lateral teeth four; sides converging posteriorly.

Carapace very thick, smooth, very finely punctate; sides converging posteriorly, regions well marked. Front deflexed, in a dorsal view seeming faintly bilobed. Lateral margin with four teeth, diminishing in size from the anterior or orbital to the posterior. Orbital margin sinuous, sloping obliquely backward and outward, a tooth near the inner angle below.

Chelipeds in the female equal, granulate, especially toward the margins. Merus with a spine on the superior margin. Carpus longer than wide, with a slender forward-pointing spine at the inner angle. Propodus with a granulated ridge on its upper and lower margins; lower margin concave. Fingers as long as the palmar portion. Dactylus with two granulated ridges on its upper surface; light brown color extending nearly to the articulation. Color of pollex extending only half its length. Teeth irregular and shallow. Tips curved, acuminate, crossing each other. Gape slight. Upper surface of carpus, propodus and dactylus sparsely hairy. Lower surface of last two joints of ambulatory legs fringed with very fine hairs.

Dimensions.—Length 4.7, anterior width 5.9, width of front 2.2 mm.

Type locality.—Curaçao, steamer "Albatross," one female (U. S. Nat. Mus. No. 19974).

GRAPSIDÆ.

106. GONIOPSIS CRUENTATUS (*Latreille*).

Spanish Wells, Bahamas.

107. GRAPSUS GRAPSUS (*Linnæus*).

Bahia Honda, Cuba, on wharves; Egg Island and Spanish Wells, Bahamas.

108. PACHYGRAPSUS TRANSVERSUS *Gibbes*.

Dry Tortugas.

109. PLANES MINUTUS (*Linnæus*).

Tortugas, in gulf weed; lat. 31° 30′ N., long. 75° 11′ W.

110. SESARMA (HOLOMETOPUS) MIERSII *Rathbun*.

Egg Island, Bahamas.

111. ARATUS PISONII *Milne Edwards*.

Bahia Honda, Cuba.

112. PLAGUSIA DEPRESSA (*Fabricius*).

Spanish Wells, Bahamas.

113. LEIOLOPHUS PLANISSIMUS (*Herbst*).

Egg Island, Bahamas.

CALAPPIDÆ.

114. CALAPPA FLAMMEA (*Herbst*).

Tortugas.

CALAPPA SULCATA sp. nov. Pl. IX, Figs. 3 and 4.

Teeth of posterior margin produced; manus with a smooth sulcus.

This species is closely related to *C. flammea* (Herbst). The two specimens collected by the "Albatross" are not mature, but I have compared them with specimens of *flammea* equally small. The proportions of the carapace are similar to those of *flammea:* so also are the larger tubercles which ornament the longitudinal elevations, the smaller intervening tubercles are, however, much flatter and less conspicuous than in *flammea.* The posterior two-fifths of the carapace is very finely granulate, the granules barely visible to the naked eye, while in *flammea* they are always evident. The most striking difference in the carapace of the two species is the great length and slenderness of the median pair of teeth of the posterior border and also the spiniform teeth at the postero-lateral angle. In *flammea* there is a small tooth just outside the median pair; this tooth is absent in *sulcata.* The margin of the orbit is subentire; in *flammea*, incised with tuberculiform teeth.

The chelipeds differ as follows from those of *flammea.* Above the inferior margin of the palm (Fig. 4) there is an oblique row of four or more large granulated tubercles; above this row there is a broad and deep sulcus having a smooth surface, and continued in a direction subparallel to the distal margin of the palm. In *flammea*, the area above the inferior margin is granulate and has one or two small tubercles; above this there is a depression corresponding to that in *sulcata*, but shallow and granulate.

Dimensions.—Female, length, median 13.7; entire length 14.6; greatest width, across postero-lateral angles, 17.5 mm.

Range.—Type locality, off the Delta of the Mississippi, station 2388, lat. 29° 24′ 30″ N., long. 88° 01′ W., 35 fathoms, one female (U. S. Nat. Mus. No. 14941). One additional female was taken off Cape Hatteras, N. C., station 2296, lat. 35° 35′ 20″ N., long. 74° 58′ 45″ W., 27 fathoms (U. S. Nat. Mus. No. 8817).

115. CALAPPA ANGUSTA *A. Milne Edwards.*

Stations 24, 26 and 47, off Key West, 60 to 80 fathoms.

116. CALAPPA GALLUS (*Herbst*) (=C. GALLOIDES *Stimpson.*)

Tortugas.

117. CYCLOES BAIRDII *Stimpson.*

Spanish Wells, Bahamas, 6 fathoms. One female, which differs from the types from Cape St. Lucas only in its rougher and more uneven surface.

118. OSACHILA TUBEROSA *Stimpson.*

Station 24, off Key West, 60 fathoms; off Havana.

LEUCOSIIDÆ.

119. SPELŒOPHORUS ELEVATUS sp. nov. Pl. III, Fig 1.

Station 46, off Key West, shallow water; one female.

Carapace very high; four large branchial openings; antero-lateral and lateral margins subequal; two posterior marginal lobes reduced.

Allied to *S. triangulus* A. Milne Edwards, but the carapace is narrower and much higher. In *triangulus* the highest point of the dorsal surface is at the anterior end of the ridge which defines the inner and posterior boundary of each branchial region; in *elevatus* the highest point is at the middle of this ridge. Hepatic region convex; subhepatic tooth prominent, blunt. Branchial margin with three lobes, one of which is antero-lateral. The lobe at the postero-lateral angle is much the largest and most produced. The branchial hollows are much larger than in the other species of the genus; the posterior openings are each nearly as large as the cardiac lobe; the anterior openings are each about one-half as large as the posterior, and separated from them by narrow bridges. The surface between the anterior openings is much depressed. The two lobes of the posterior margin are small and subtriangular. The outer surface of the merus of the chelipeds has three blunt thickened lobes or teeth. The palm is much swollen; its anterior or outer margin has a bilobed crest. The upper surface of the crab is covered with depressed granules so crowded as to present a honey-comb structure. The more elevated portions are in addition tuberculated. On the lower surface, there are many more tubercles, which are large and bead-like, and tend to form on the abdomen reticulating lines. The tubercles margining the ambulatory legs are large and acorn-shaped.

Dimensions.—Length 9.7, width at postero-lateral angles 12, width at median lateral lobe of the branchial region 11.4, height 5, greatest diameter of posterior opening 3.1, least diameter 2 mm.

120. ILIACANTHA SUBGLOBOSA *Stimpson.*

Stations 25 and 26, off Key West, 60 fathoms; station 41, off Sand Key, 15 fathoms.

ILIACANTHA LIODACTYLUS sp. nov. Pl. VIII, Fig. 2.

Three posterior acute spines; fingers longer than palm; dactyli of ambulatory legs not grooved.

The shape of the carapace is broadly oval, as in *subglobosa.* The granules are visible to the naked eye but are not large as in *sparsa* and *intermedia;* they are distant from one another and the intervening space is covered with minute punctæ. The lateral margin is bluntly angulate on the hepatic region and again on the branchial region about half way back on the carapace; the margin is indicated by a definite line of crowded acute granules. The three posterior protuberances are acute, conical spines, upturned at the tips, the lateral pair two-thirds the length of the median. The front is not prominent, is slightly inclined upward and divided into two blunt, finely granulated teeth separated by a shallow sinus. It is wider proportionally than in *subglobosa*. The pterygostomian channel projects only slightly beyond the orbital margin and does not exceed the front; of the two notches at its extremity, the outer is broad, deep and U-shaped, the inner is very shallow. The outer maxillipeds are similar to those of *subglobosa;* the exognath reaches nearer the end of the upper margin of the pterygostomian channel than in that species. In the abdomen of the male, the third, fourth and fifth segments are coalesced, and the sixth is partially soldered to these, the dividing line being visible. The sutures between the first, second and third segments are not as clearly marked as in *subglobosa*. The abdomen for the greater part of its length is narrower than in *subglobosa*.

Chelipeds about twice the length of the carapace. Merus a little shorter than the carapace, exclusive of posterior spine, slender, cylindrical, not tapering, coarsely and rather densely granulate, with a blunt tooth at the posterior proximal end, as in *subglobosa*. Carpus and manus finely granulate. Palm narrowing distally, a little more than three times as long on its outer margin as its greatest width. Dactylus about one-fourth longer than the palm; armature similar to that of *subglobosa*, that is, there are about eight longer, slender spines at tolerably regular intervals, the interspaces with from nine to twelve small irregular spines. The ambulatory legs are slender; propodi less compressed than in *subglobosa;* dactyli smooth and furnished with a fringe of hair on opposite sides (superior and inferior margins); this fringe is longer and more noticeable than in *subglobosa* where the two lines are near together, on the upper and posterior surfaces, and the dactyli are deeply grooved.

Dimensions.—Immature male, length to tip of median spine 17, length exclusive of spine, 14.5, width 13.6, length of merus of cheliped, on posterior margin 13.9, length of manus, along posterior or outer margin 6.5, length of dactylus 8.6 mm.

Range.—Type locality, north of Trinidad, 31 to 34 fathoms, stations 2121 and 2122, steamer "Albatross" (U. S. Nat. Mus. No. 20327). Taken also at St. John one of the Danish West Indies by Œrsted; one immature female (Copenhagen Museum).

121. EBALIA STIMPSONII *A. Milne Edwards.*

Bahama Banks, from millepores.

122. LITHADIA CADAVEROSA *Stimpson.*

Bahama Banks.

DORIPPIDÆ.

123. ETHUSA MASCARONE AMERICANA *A. Milne Edwards.*

Station 45, off Key West, shallow water.

124. ETHUSA TENUIPES *Rathbun.*

Stations 27, 39, 41 and 47, off Key West and Sand Key, 15 to 80 fathoms.

125. CYMOPOLUS ASPER *A. Milne Edwards.*

Stations 28, 30, 33, 35, 51, 52, 56, 62, 63, 64, off Key West, Sand Key and American Shoal, 70 to 200 fathoms.

126. CYCLODORIPPE NITIDA *A. Milne Edwards.*

Stations 27, 30, 51 and 52, off Key West and American Shoal, 50 to 110 fathoms. Abundant at stations 30 and 51.

127. CYCLODORIPPE ANTENNARIA *A. Milne Edwards.*

Station 27, off Sand Key, 50 to 60 fathoms; off Havana.

CYCLODORIPPE GRANULATA sp. nov. Pl. IX, Fig. 1.

Coarsely granulate. Posterior greater than anterior width.

Superior and inferior surfaces closely and coarsely granulate. Carapace broader than long; posterior greater than exorbital width; very convex in a transverse direction, slightly so in a longitudinal direction. Branchio-cardiac grooves deep; mesogastric region partly outlined by converging grooves;

protogastric lobes with faint longitudinal impressed lines. Lateral margin with a small sharp spine about the middle of its length; margin behind the spine tuberculous. Front with a median tooth, elevated, blunt, smooth at the tip, having a median sulcus, concave beneath, forming the roof of the buccal cavity; on either side is a depressed and inconspicuous tooth. Preorbital tooth large, subacute, not quite so advanced as the front. Postorbital tooth acute, directed obliquely forward. Endognath of maxillipeds longitudinally grooved. The left cheliped, the only one with the specimen, is very slender and coarsely granulate; the fingers as long as the palm.

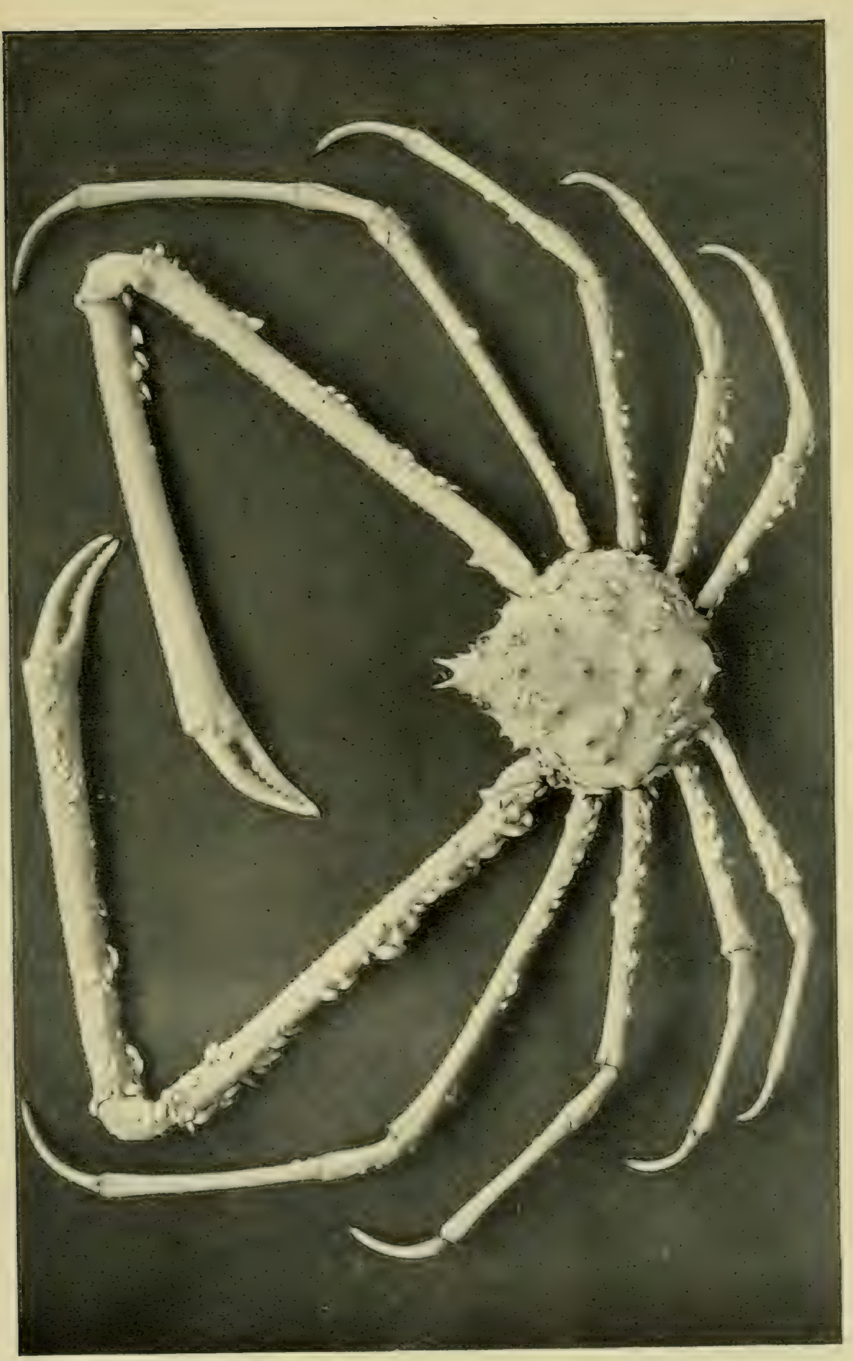
Dimensions.—Female, length 2.8, width 3 mm.

Type locality.—Off Trinidad, lat. 11° 07′ N., long. 62° 14′ 30″ W., 73 fathoms, station 2120, one female (U. S. Nat. Mus. No. 20510).

Explanation of Plate I.

Anamathia crassa, ♂, × ⅜.

PLATE I.



EXPLANATION OF PLATE II.

Fig. 1. *Collodes armatus*, ♀, × 2.

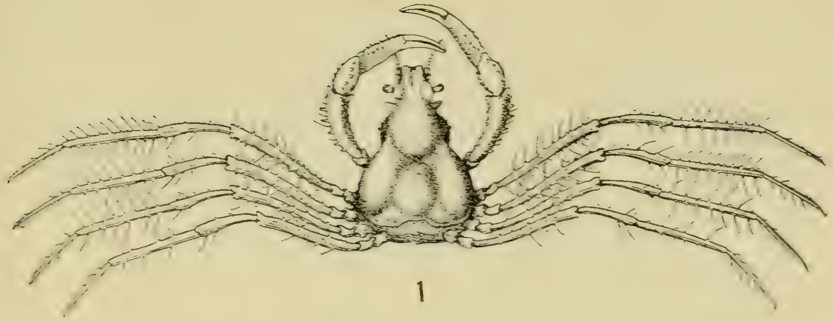
Fig. 2. *Anasimus latus*, ♂, × $\frac{1}{2}$.

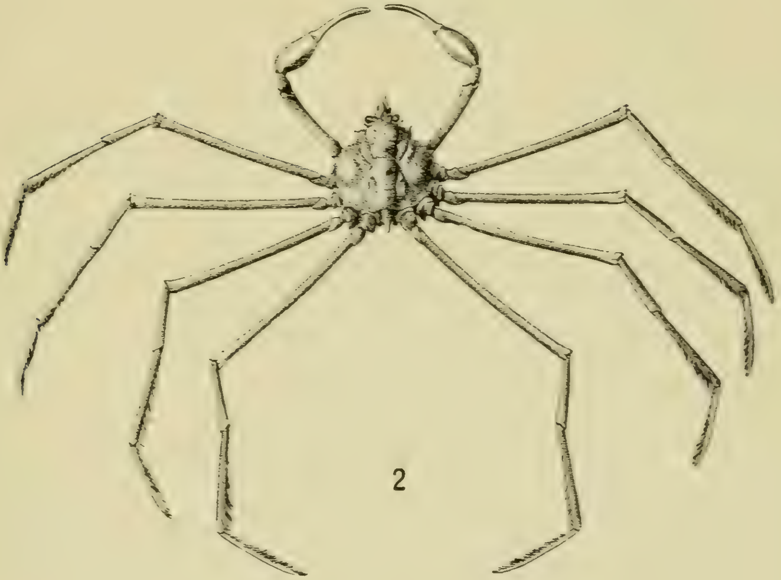
Fig. 3. *Anasimus latus*, outer maxilliped, × 2.

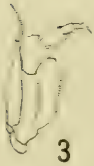
Fig. 4. *Anasimus latus*, ♂, ventral view, × $\frac{1}{2}$.

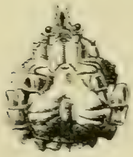
Fig. 5. *Anasimus latus*, ♂, profile, × $\frac{1}{2}$.

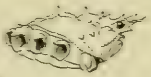
PLATE II.


1


2


3


4

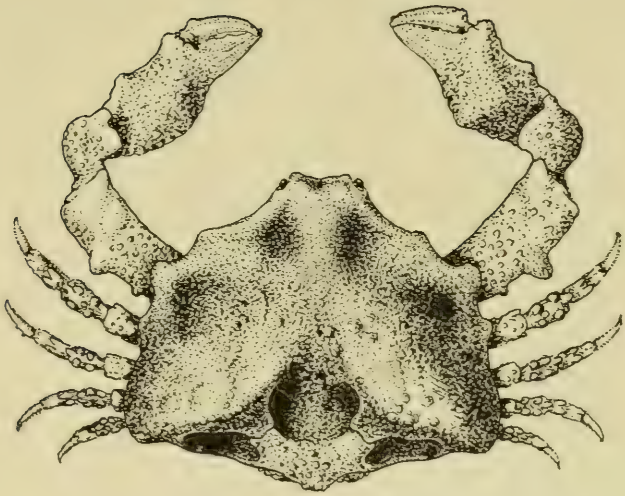

5

EXPLANATION OF PLATE III.

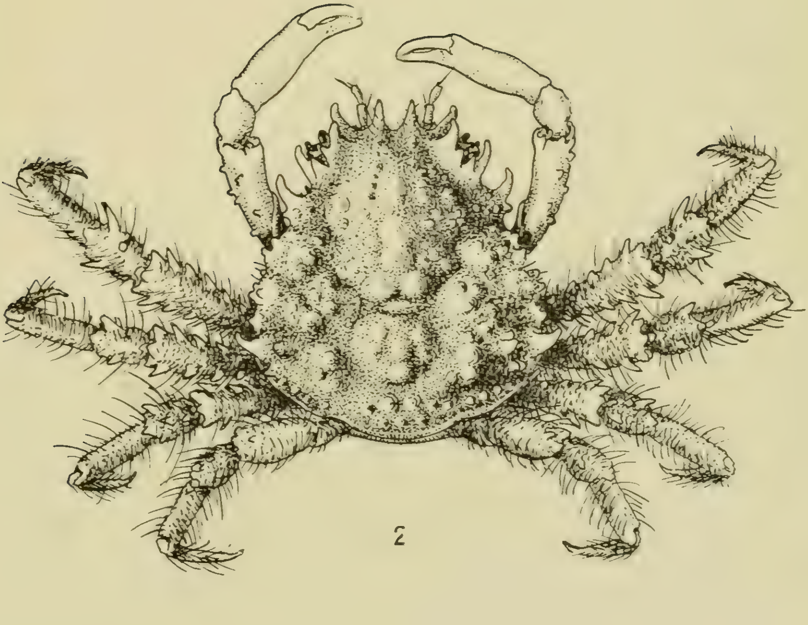
Fig. 1. *Spelæophorus elevatus* ♀, × $3\frac{1}{5}$.

Fig. 2. *Mithrax holderi*, ♀, × $1\frac{3}{5}$.

PLATE III.



1



2

EXPLANATION OF PLATE IV.

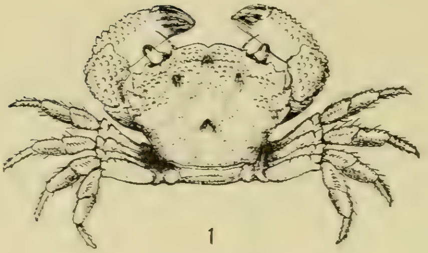
Fig. 1. *Xanthias nuttingi*, ♂, × 4⅘.

Fig. 2. *Micropanope truncatifrons*, ♀, × 3⅕.

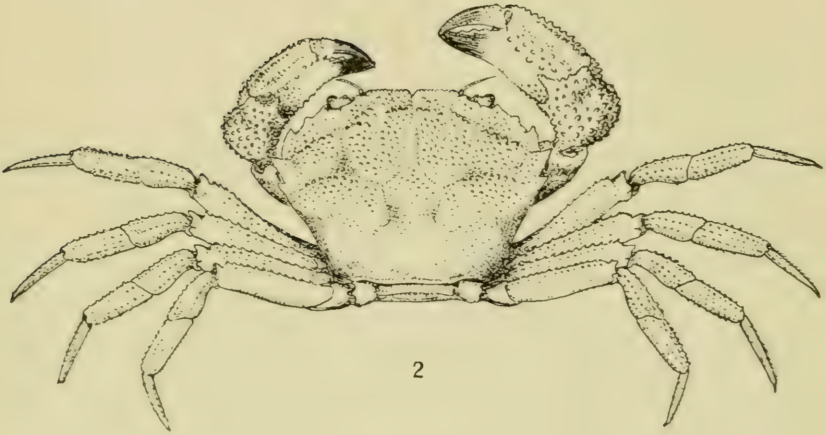
Fig. 3. *Actæa bifrons*, ♂, front, × 6⅖.

Fig. 4. *Actæa bifrons*, ♂, × 3⅕.

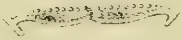
PLATE IV.



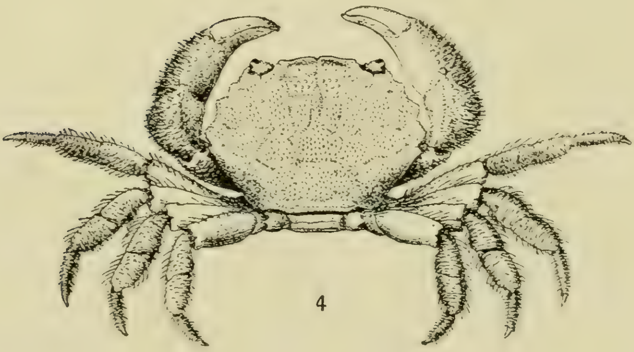
1



2



3



4

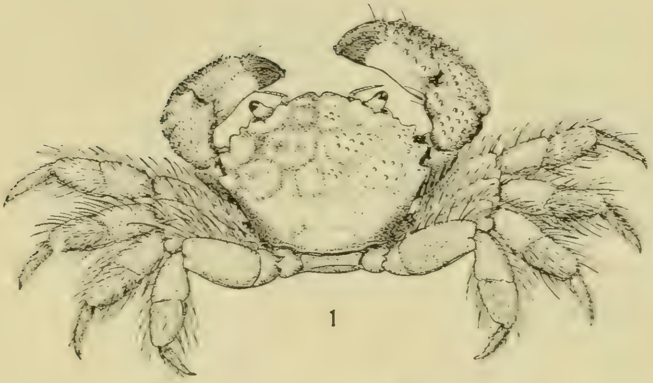
EXPLANATION OF PLATE V.

Fig. 1. *Pilumnus holosericus*, ♂, showing tubercles on right half, × 3.

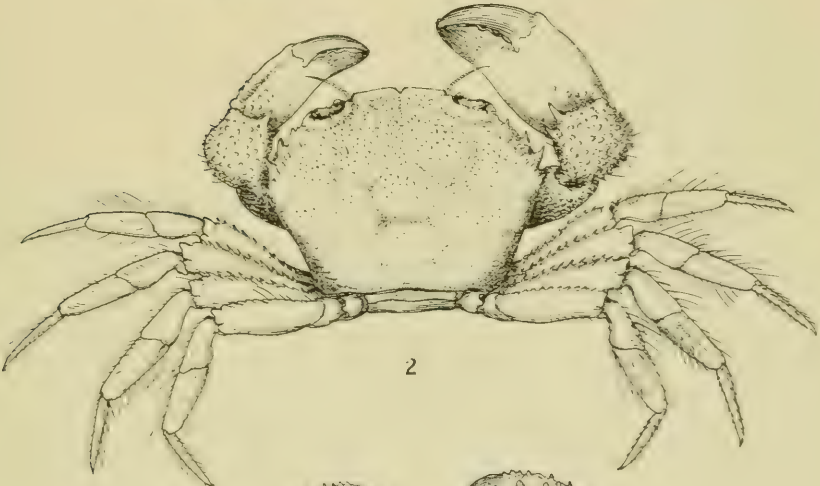
Fig. 2. *Pilumnus andrewsii*, ♀, × 3.

Fig. 3. *Pilumnus spinosissimus*, ♂, × 3.

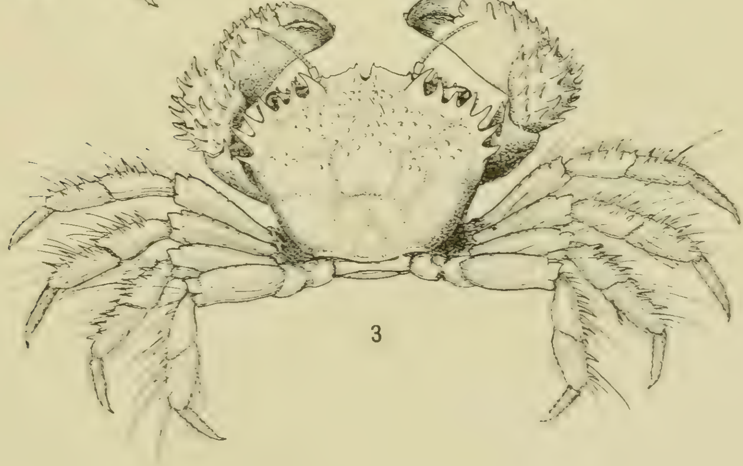
PLATE V.



1



2



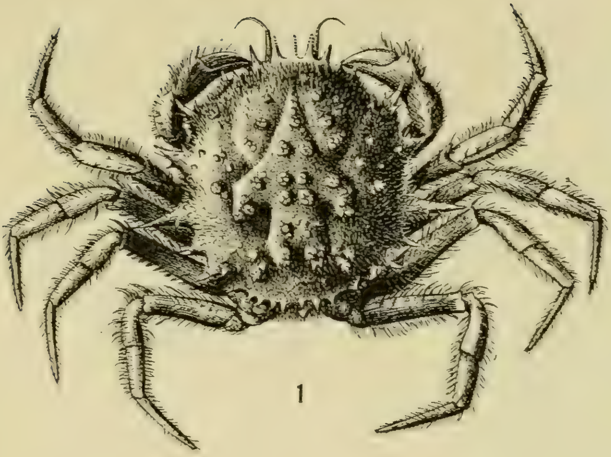
3

EXPLANATION OF PLATE VI.

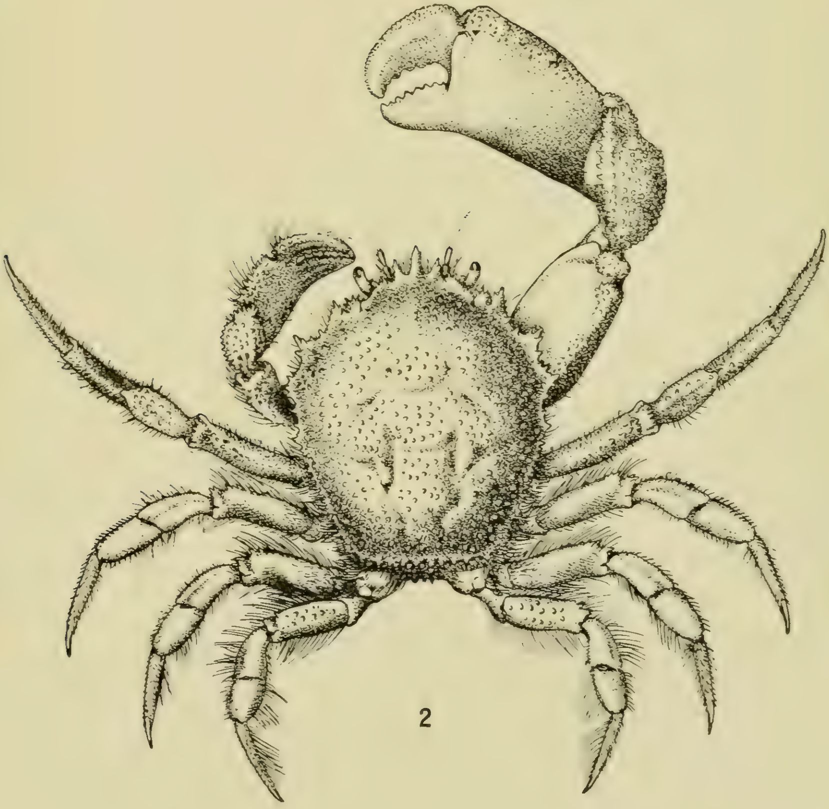
Fig. 1. *Trachycarcinus spinulifer*, ♂, $\times 1\frac{1}{8}$.

Fig. 2. *Hypopeltarium dextrum*, ♂, $\times \frac{15}{16}$.

PLATE VI.



1



2

EXPLANATION OF PLATE VII.

Fig. 1. *Pilumnoplax americanus*, ♂, × 1½.

Fig. 2. *Pilumnoplax americanus*, ♂, front, × 2.

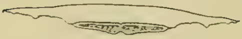
Fig. 3. *Chasmocarcinus typicus*, ♂, × 2.

Fig. 4. *Chasmocarcinus typicus*, ♂, abdomen and sternum, flattened, × 2.

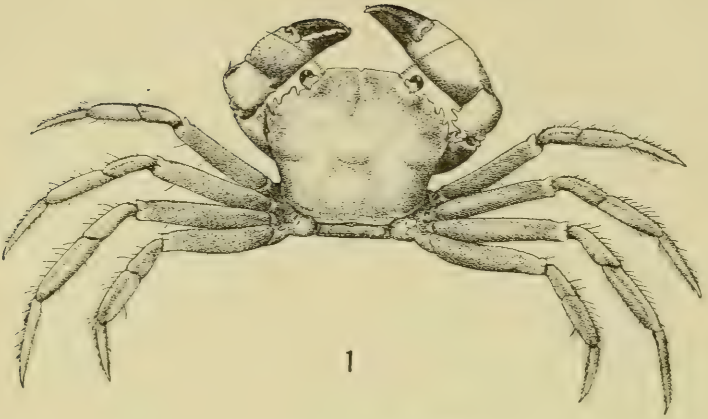
Fig. 5. *Chasmocarcinus typicus*, ♂, outer maxillipeds, × 2.

Fig. 6. *Chasmocarcinus obliquus*, carapace of ♂, × 2.

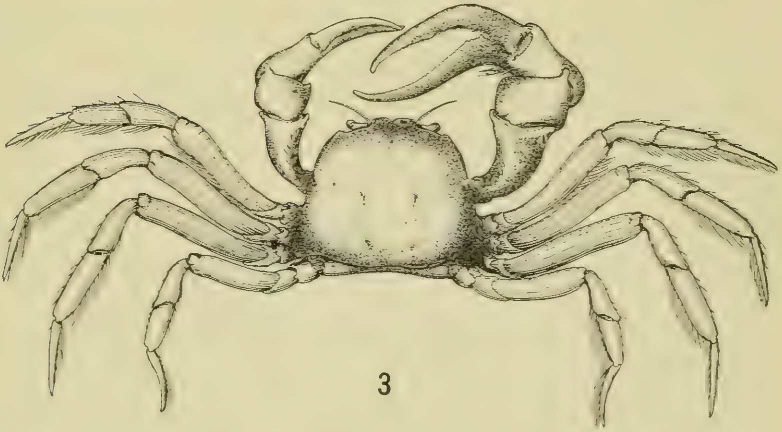
PLATE VII.



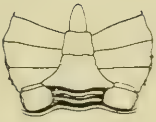
2



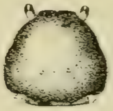
1



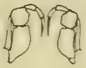
3



4



6



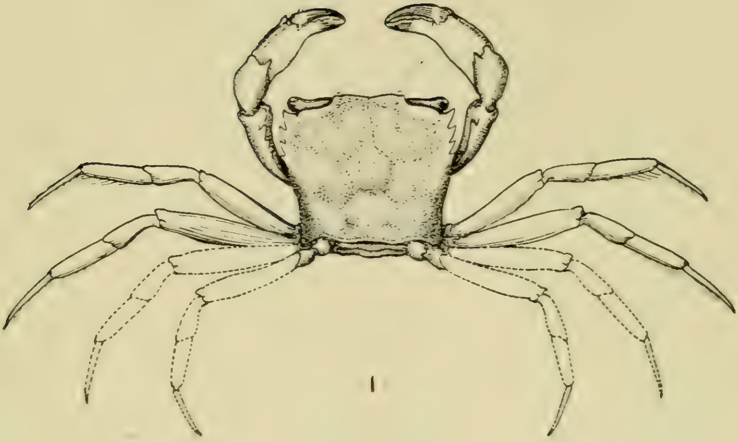
5

EXPLANATION OF PLATE VIII.

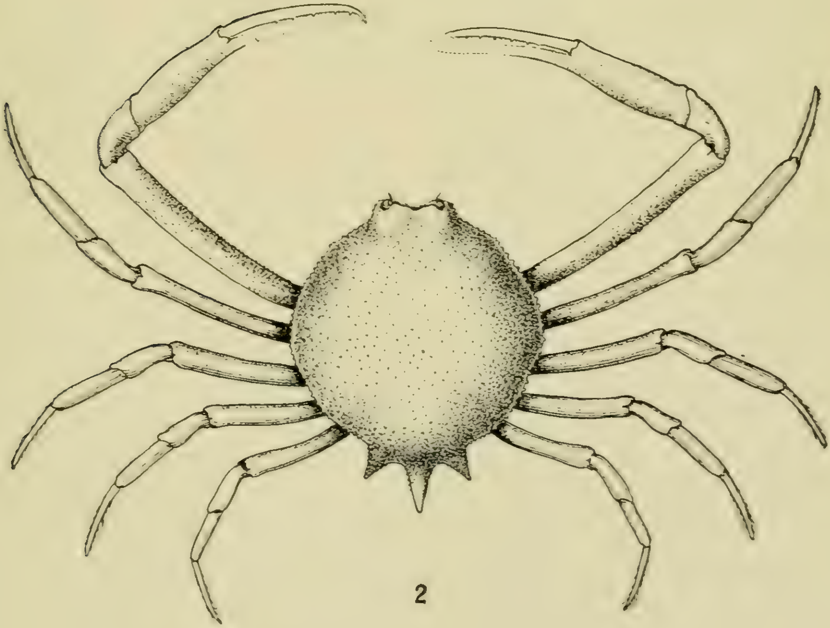
Fig. 1. *Frevillea quadridentata*, ♀, × 3¾.

Fig. 2. *Iliacantha liodactylis*, ♂, × 2¼.

PLATE VIII



1



2

EXPLANATION OF PLATE IX.

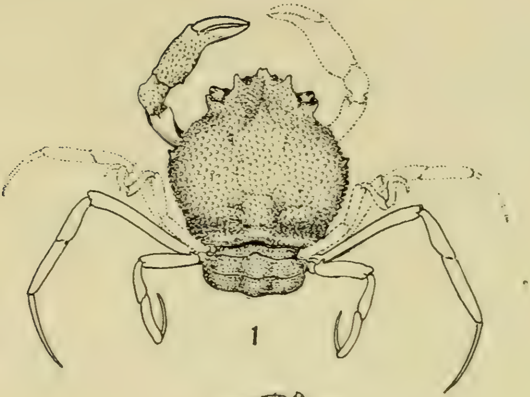
Fig. 1. *Cyclodorippe granulata*, ♀, × 6¾.

Fig. 2. *Palicus bahamensis*, ♂, × 3.

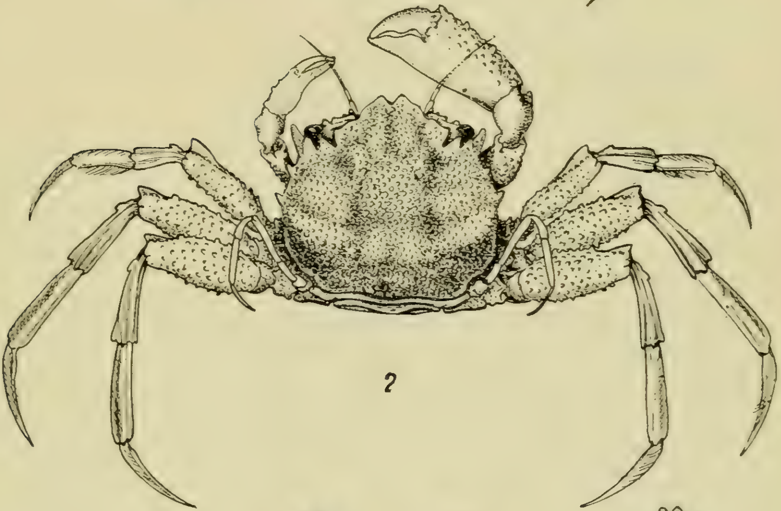
Fig. 3. *Calappa sulcata*, ♀, × 2¼.

Fig. 4. *Calappa sulcata*, ♀, left hand, × 2¼.

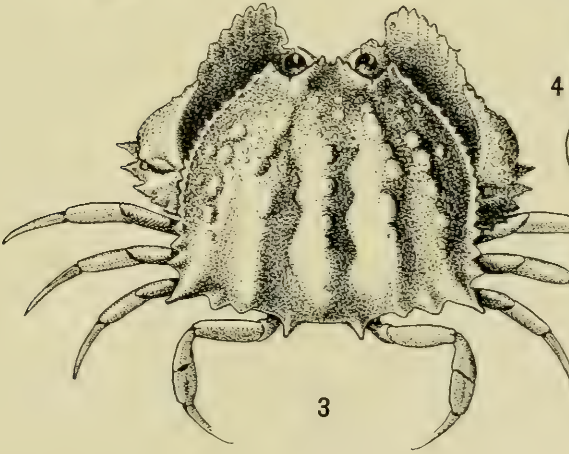
PLATE IX.



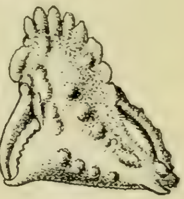
1



2



3



4

THE BEETLES OF SOUTHERN ARIZONA.

BY H. F. WICKHAM.

THE following list includes beetles collected by the author during a trip to Southern Arizona and the adjacent portions of California, in the summer of 1890. While incomplete, it will serve to give an idea of the fauna of a most interesting region with which most collectors are unacquainted. It is long since any works have been published treating of the Coleoptera of the southern part of the Territory, the papers by Dr. J. L. Le Conte[1] being the last relating to the subject as a whole, though numerous short notes or descriptions of isolated species have appeared from time to time

It will be noticed by the student of geographical distribution that the insects of northern Arizona[2] are widely different from those of the southern part. This is due mostly, no doubt, to the difference in altitude, since the former region is a highly elevated plateau lying to a great extent within or above the piñon belt. On the other hand the southern plains are chiefly low, and only on the mountains have I met with coniferous trees of any kind. The giant cactus is unknown in the north and many other large cacti which abound to the southward seem to be lacking elsewhere. The "maguey" and several other spiny plants of allied families, which are abundant along the lower half of the territory, are much less frequently seen to the northward. The mesquite grows commonly about

---

[1] "Catalogue of Coleoptera of the region adjacent to the boundary line between the United States and Mexico". Jour. Acad. Phil., 1858; and "List of Coleoptera collected near Fort Whipple, Arizona, by Dr. Elliott Coues, U. S. A., in 1864-5". Proc. Acad. Phil., 1866.

[2] See "A List of some Coleoptera from the northern portions of New Mexico and Arizona," by H. F. Wickham, in Vol. III of this Bulletin.

Tucson and reaches the Colorado river—at the latter place the screw-bean (*Prosopis*) abounds.

Work was begun at Tucson, which lies at an altitude of about 2,400 feet,[1] in the valley of the Santa Cruz river, an insignificant stream except when swollen by the heavy rains of July and August. In the immediate vicinity of town the ground is mostly flat, though rugged and rocky hills are within easy walking distance, while farther away rise the mountains which nearly surround the plain. To the eastward looms the Santa Catrina range; the Santa Rita Mountains are about thirty miles to the southward, while the Tucson Mountains lie more to the west, The vegetation of the Santa Cruz Valley, except in the river bottom, consists of such plants as can flourish in a gravelly or sandy soil of such porous nature that it dries almost at once after a rain. In consequence we find mesquite, screw-bean, various other thorny leguminous shrubs, the "*palo verde*" and the like. *Cereus giganteus*, the giant cactus, the fruit of which is sought after by the Indians, and various other cacti, flourish here. *Opuntias* grow to a considerable size and fruit in profusion. "Montezuma's compass" a great cactus of nearly the size and shape of a nail-keg is often met with. There is no turf, such grass as exists being scattered.

The first stop at Tucson was made simply as a necessary preliminary to a trip across the country in the direction of the upper Gila River. Consequently on the morning of June 16th I took the train for Casa Grande which is a small settlement in a semi-desert region and owes its chief interest to the ruins of the great Aztec house near by. The altitude is said to be 1398 feet. But little collecting could be done as the stage left in a few hours for Florence and Riverside, the latter being my immediate destination. The ride was very enjoyable, since beyond Florence the road passed directly through the giant cactus belt and the effect of these great trunks in the semi-darkness of evening was extremely weird.

---

[1] The altitudes quoted are taken from Bull. No. 5, of the U. S. Geological Survey, Washington, 1884.

Riverside lies in Pinal county, on the upper Gila River, at the mouth of a small stream called Mineral Creek. This creek comes down a deep cañon, which was once the scene of considerable activity during the development of certain copper mines. A concentrating mill and smelter mark the investment of capital in what was without doubt a promising undertaking. At the time of my visit the Ray mine was undergoing careful examination at the hands of Dr. Edward D. Peters, Jr., to whose kindness I am indebted for the opportunity of visiting this neighborhood.

The altitude of Riverside is unknown to me. It is however in close proximity to the foot-hills of the Pinal Mountains and considerable difference is found between its insect fauna and that of Tucson. In the cañon are a good many cottonwood trees, but no timber of any other kind of sufficient size for use in building. The hills bear a few *Cereus giganteus* but they are rather small and evidently the limit of their growth is nearly reached at this altitude. For the remainder of June I collected mostly in this cañon, from the mouth to a distance of perhaps eight miles up the creek. This collection is referred to Riverside in the list.

A side trip of a few days was made in order to see something of the higher levels. On the 24th of June I had the opportunity of accompanying Dr. Peters on a ride through the Pinal Mountains. This range is of considerable height and furnishes much pine lumber of good size, sawmills having been established to supply the local demand for building purposes and mine timbers. The lower slopes of the system show the usual transition from the plains flora, to that of pine-clad summits, the most remarkable feature being the great development of maguey, bear-grass and yuccas before reaching the belt of oak scrub. Our camp was made in the pine timber some little distance below Kellner's saw-mills and most of the collecting was done in the immediate neighborhood. Before returning a short visit was made to Globe, and the few insects taken at that place are characteristic of the plains.[1]

[1] A separate account of this region has been published by the author in "Entomological News."

Leaving Riverside, July 2d, the return trip to Tucson was made across the plains in a buck-board. This eighty-mile ride was broken only by short stops for eating and sleeping, so but few beetles were found. Dead and dying cattle marked the road—outlying stragglers of the thousands which perished during the summer drought, offering mute evidence of the barrenness of these vast semi-desert tracts where water is so scarce that a slight diminution of the normal supply means death to thousands of the brute inhabitants.

From Tucson I went at once to Yuma, which is situated on the Arizona side of the Colorado River. The fort on the other bank has been long since abandoned, but during its occupation formed a center from which a great deal of entomological collecting was done. Most of my own captures were made on the California shore, since it seemed much more productive than the other. The valley is occupied by Indians who raise crops of corn, beans and melons by irrigation and it would no doubt well repay development by capital. The only timber is found in the river bottom and consists of mesquite and screw-bean on drier spots, replaced by willows along the water front. The principal drawback to life is found in the temperature which at this low altitude (142 feet) in a river valley, bordered by burning deserts becomes much too warm for comfort.

After collecting a short time at Yuma, a visit was made to other California points, but as these are not included in the scope of my article, no account need be taken of them. Returning about the beginning of August, I went next to Gila Bend, about 120 miles to the eastward, measuring by direct line. Lying, as it does, in the Gila Valley, at an altitude of 739 feet, about five miles from the river, it should offer a good opportunity for completing a survey of the insects of the region traversed by that stream, since it is about half way between Riverside and Yuma; the one is on the upper waters while the other marks the junction with the Colorado. Unfortunately the collections were very meagre, but showed more affinity to those made at Yuma than to those of Riverside.

This would be expected from the desert aspect of the neighborhood, except in the river bottom, where the Papago Indians have a small reservation on which they successfully cultivate their accustomed crops.

By this time the rainy season had thoroughly set in and insects might soon be expected to appear in larger numbers. Repairing now to Tucson, which was reached on the fourth of August it was found that the street lights, after a storm, attracted vast numbers of beetles, many of which had not been met with in the course of previous work. By far the best captures were made here in the three weeks following, the regular labor being broken only by two short excursions made in company with Dr. Peters, whom I again had the pleasure of meeting. The first of these trips took us to the Tucson Mountains, where some very rare specimens were obtained. Whether or not any of these mountains extend up into the pine belt, I am unable to say—but at the points we reached, the giant cactus had not yet ceased to grow. The Santa Rita range, which we next examined, is much more lofty, but we did not get far above the cactus line—only a short distance into the oak scrub. Still the herbaceous plants are largely different from those of the Santa Cruz valley and some of the beetles were not contained in any of our previous collections. The genus *Acmæodera* was finely represented on composite flowers, though not seen abundantly any where else that summer.

For assistance in identifying material I am under obligations to Capt. Thos. L. Casey and the late Dr. Geo. H. Horn, as well as to several specialists who have examined specimens belonging to those families with which they are most familiar.

LIST OF SPECIES.

CICINDELIDÆ.

AMBLYCHILA sp. A single specimen was found by Dr. Peters under a log in a damp spot by the roadside near Kellner's mill in the Pinal Mts.

TETRACHA CAROLINA Linn. Tucson. Common about the street lights but not met with elsewhere in that vicinity. Yuma.

CICINDELA LEMNISCATA Lec. Tucson. Along sides of railroad track, running actively by day; also abundant near lights in the evening.

CARABIDÆ.

Omophron gilæ Lec. Gila Bend. Abundant on river banks.

O. obliteratum Horn. Riverside. On banks of Gila river.

Cychrus snowii Lec. Pinal Mts. Several specimens were taken by Dr. Peters and myself under logs or among dead leaves in the wet ground close to a spring.

Calosoma prominens Lec. Pinal Mts.

Notiophilus semiopacus Esch. Pinal Mts. Under stones or logs.

Scarites subterraneus Fabr. Yuma. Many specimens of the small form common in the Colorado valley were taken under pieces of wood near the river.

Dyschirius analis Lec. Yuma. Not uncommon on wet mud.

D. pumilis Dej. Tucson.

Clivina dentipes Dej. Yuma. Burrowing in wet mud.

C. ferrea Lec. Tucson. Several specimens which Dr. Horn considered a variety of this species were taken at lights.

Schizogenius depressus Lec. Riverside. On sandy creek banks.

S. pluripunctatus Lec. Yuma.

Bembidium lugubre Lec. Riverside.

B. lucidum Lec. Riverside.

B. nubiculosum Chaud. Yuma, Riverside.

B. intermedium Kby. Tucson.

B. versicolor Lec. Tuscon, Riverside.

B. timidum Lec. Riverside. All the above species of this genus were taken on banks of streams or pools. The names are from Mr. Hayward.

Pericompsus sp. Riverside, Tucson.

Pterostichus lætulus Lec. Tucson, Yuma.

P. lustrans Lec. Pinal Mts.

Amara californica Dej. Shady Run, near foot of Pinal Mts.

Calathus dubius Lec. Pinal Mts.

Platynus brunneomarginatus Mann. Pinal Mts.

P. decorus Say. Tucson.

P. texanus Lec. Tucson.

Lachnophorus elegantulus Mann. Riverside. On creek banks.

Thalpius hornii Chaud. Tucson.

Ega lætula Lec. Yuma. Abundant on banks of pools.

Tetragonoderus pallidus Horn. Tucson. Under boards along track.

Lebia grandis Hentz. Tucson. At street lamps

L. viridis Say. Pinal Mts. In the oak scrub belt.

Apristus subsulcatus Lec. Tucson.

Axinopalpus biplagiatus Dej. Riverside.

Philophuga amœna Lec. Shady Run, foot of Pinal Mts.

Cymindis laticollis Say. Pinal Mts.

Brachinus lateralis Dej. Tucson.

Chlænius ruficauda Chaud. Yuma. On river bank.

C. cumatilis Lec. Riverside. Under stones along the creek and river bottoms.

C. pennsylvanicus Say. Tucson.

Oodes elegans Lec. Riverside. On banks of Gila.
Discoderus robustus Horn. Tucson Mts.
D. cordicollis Horn. Tucson, Globe, Tucson Mts.
Harpalus obliquus Horn. Tucson.
Selenophorus gagatinus Dej., var. Tucson.
Bradycellus rupestris Say, var. *congener* Lec. Tucson.

HALIPLIDÆ.

Cnemidotus simplex Lec. Riverside. Abundant.

DYTISCIDÆ.

Laccophilus decipiens Lec. Riverside.
L. pictus Lap. Riverside.
Desmopachria latissima Lec. Riverside.
Bidessus cinctellus Lec. Riverside.
B. amandus Lec. Riverside.
Cœlambus sp. Yuma.
Hydroporus near addendus Cr. Riverside.
H. vilis Lec. Pinal Mts. Abundant in a horse trough.
Copelatus chevrolatii Aubé. Tucson.
Agabus lugens Lec. Pinal Mts.
Rhantus atricolor Aubé. Pinal Mts.
Thermonectes marmoratus Hope. Riverside. A few specimens were taken in quiet pools along the creek bed.
Cybister explanatus Lec. Yuma. In ponds along the river bottoms.

HYDROPHILIDÆ.

Ochthebius puncticollis Lec. Riverside.
Hydræna sp. Riverside.
Tropisternus sp. Riverside.
Berosus punctatissimus Lec. Riverside.
B. miles Lec. Yuma. The identification is not certain.
B. subsignatus Lec. Tucson, Yuma.
B. exilis Lec. Riverside. Not abundant.
Chætarthria sp. Tucson, Riverside.
Limnebius piceus Horn. Riverside.
Laccobius agilis Rand. Riverside.
Creniphilus infuscatus Mots. Pinal Mts.

SILPHIDÆ.

Ptomaphagus fisus Horn. Pinal Mts.

PSELAPHIDÆ.

Sognorus ocularis Casey. Tucson.
Ctenisis raffrayi Casey. Tucson.

STAPHYLINIDÆ.

Tachyusa sp. Yuma.

Polyodontes sp. Riverside.

Heterothops fumigatus Lec. Riverside.

H. pusio Lec. Pinal Mts.

Quedius desertus Horn. Pinal Mts. Under leaves in damp spots or beneath logs.

Belonuchus ephippiatus Say. Santa Rita Mts., in decaying yuccas. Tucson.

Philonthus hepaticus Er. Riverside.

P. puberulus Horn. Riverside.

P. varians Payk. Riverside.

P. alumnus Er. Riverside.

P. innocuus Horn. Pinal Mts., Tucson.

Actobius gratus Lec. Yuma. On wet banks.

A. pæderoides Lec. Tucson. Common on banks of pools.

Xantholinus pusillus Sachse. Riverside.

Stenus incultus Casey. Yuma.

S. arizonæ Casey. Riverside.

Cryptobium arizonense Horn. Pinal Mts., Tucson.

Lathrobium lituarium Lec. Tucson.

L. dimidiatum Lec. Tucson.

Medon sp. Pinal Mts.

Pæderus ustus Lec. Yuma.

Sunius similis Aust. Yuma.

Pinophilus densus Lec. Yuma, Tucson.

Troglophlœus dentiger Casey. Yuma.

T. gilæ Casey. Yuma.

T. tantillus Casey. Yuma. All the above species of *Trogophlœus* were taken on the margins of pools among the willow thickets near the river.

Thinobius hesperius Casey. Yuma.

T. sp., probably new. Riverside.

Apocellus gracilicornis Casey. Riverside and Tucson, very abundant in wet places.

TRICHOPTERYGIDÆ.

Trichopteryx hornii Matth. Pinal Mts. Abundant under dead leaves near a spring.

SCAPHIDIIDÆ.

Scaphisoma rufulum Lec. Yuma.

COCCINELLIDÆ.

Megilla maculata De G. Yuma.

Hippodamia convergens Guér. Santa Rita Mts., Pinal Mts.

Chilocorus cacti Linn. Tucson.

Exochomus marginipennis Lec. Yuma.

Scymnus pallens Lec. Pinal Mts. In oak scrub.

S. flebilis Horn. Gila Bend.
S. ardelio Horn. Yuma, Riverside.
S. marginicollis Mann. Riverside.
S. nanus Lec. Pinal Mts.

ENDOMYCHIDÆ.

Epipocus unicolor Horn. Pinal Mts. Several specimens were taken under blocks of wood on the site of an abandoned saw-mill.

COLYDIIDÆ.

Rhagodera costata Horn. Riverside, Tucson. Chiefly taken under decaying yuccas or beneath boards.
Ditoma ornata Lec. Yuma. Under bark with the next species.
D. suffusa Casey. Yuma.
Lasconotus pusillus Lec. Pinal Mts.
L. n. sp. Tucson.

CUCUJIDÆ.

Silvanus opaculus Lec. Yuma.
Læmophlœus sp. Yuma.

MYCETOPHAGIDÆ.

Typhœa fumata Linn. Tucson, Gila Bend.
Diplocœlus near mus Reitt. Yuma.

DERMESTIDÆ.

Trogoderma sternale Jayne. Santa Rita Mts.
Cryptorhopalum balteatum Lec. Pinal Mts., Santa Rita Mts.
C. triste Lec. Tucson, Pinal Mts., Gila Bend.

HISTERIDÆ.

Hololepta yucateca Mars. Pinal Mts. In stem of decaying maguey.
H. populnea Lec. Riverside. Under bark of decaying cottonwoods.
Hister instratus Lec. Tucson.
H. lubricans Casey. Santa Rita Mts. In stem of decaying maguey plant.
Epierus regularis var. vicinus Lec. Yuma
E. planulus Lec. Pinal Mts.
E. nasutus Horn. Pinal Mts.
Paromalus tenellus Er. Yuma.
Saprinus lugens Er. Pinal Mts.
S. laridus Lec. Pinal Mts.
S. fimbriatus Lec. Riverside, Tucson.

NITIDULIDÆ.

Carpophilus floralis Er. Pinal Mts.
Colastus limbatus Lec. Yuma.

LATHRIDIIDÆ.

Corticaria sp. Yuma.

TROGOSITIDÆ.

TROGOSITA VIRESCENS Fabr. Pinal Mts.

TENEBRIOIDES sp., probably SINUATA Lec. Pinal Mts.

HESPEROBÆNUS ABBREVIATUS Mots. Pinal Mts.

BACTRIDIUM STRIATUM Lec. Yuma.

BYRRHIDÆ.

LIMNICHUS ANALIS Lec. Riverside.

PHYSEMUS MINUTUS Lec. Yuma. This has the habits of a *Limnichus* and comes out of its burrow in wet banks when water is thrown thereon.

PARNIDÆ.

DRYOPS PRODUCTUS Lec. Common in the creek at Riverside, under stones. A new species of the family, not placed as to its generic affinities, was taken at street lamps in Tucson.

HETEROCERIDÆ.

HETEROCERUS COLLARIS Kies. Riverside.

H. PUSILLUS Say. Yuma.

ELATERIDÆ.

LACON ILLIMIS Horn. Tucson.

MERISTHUS SCOBINULA Cand. Tucson.

CHALCOLEPIDIUS WEBBII Lec. Yuma. Rather abundant on living willow trees, either near the ground or among the branches.

ALAUS LUSCIOSUS Hope. Riverside.

HORISTONOTUS SIMPLEX Lec. Tucson, at street lamps.

ESTHESOPUS DISPERSUS Horn. Pinal Mts.

CRYPTOHYPNUS PECTORALIS Say. Riverside, rather abundant along the creek bottom. Pinal Mts.

MONOCREPIDIUS SORDIDUS Lec. Pinal Mts.

M. ATHOIDES Lec. Tucson, not uncommon at lights.

DICREPIDIUS CORVINUS Cand. Tucson.

ELATER FASTUS Lec. Tucson, Riverside.

DRASTERIUS ELEGANS Fabr. Riverside.

LUDIUS TEXANUS Lec. Tucson, Riverside.

DOLOPIUS LATERALIS Esch. Tucson.

MELANOTUS FISSILIS Say. Yuma, Tucson Mts.

M. CRIBRICOLLIS Cand. Tucson Mts. A rare species which had been lost for many years. A few examples were found under a dead yucca trunk.

APLASTUS CORYMBITOIDES Horn. Pinal Mts.

THROSCIDÆ.

THROSCUS sp. near SERICEUS Lec. Pinal Mts.

BUPRESTIDÆ.

HIPPOMELAS SPHENICUS Lec. Tucson, Santa Rita Mts. Not infrequently found on various shrubs and trees, usually resting near ends of small branches.

H. cælatus Lec. Tucson, Santa Rita Mts. Occurs with the preceding species but is less common.

Psiloptera webbii Lec. Santa Rita Mts. The few I saw were on mesquite trees.

Anthaxia flavimana Gory. Pinal Mts. In oak scrub.

Melanophila longipes Say. Yuma.

Chrysobothris octocola Lec. Yuma, Tucson.

C. cuprascens Lec. Pinal Mts.

C. atrofasciata Lec. Yuma. One specimen.

Actenodes calcarata Chevr. Tucson, Yuma.

Thrincopyge ambiens Lec. Santa Rita Mts.

Polycesta velasco Lap. & G. Yuma.

Acmæodera amplicollis Lec. Santa Rita Mts.

A. macra Horn. Tucson.

A. gibbula Lec. Tucson, Yuma.

A. stigmata Horn. Tucson. Found in large numbers flying about flowers of a mimosa.

Agrilus niveiventris Horn. Yuma.

A. pusillus Say. This identification was made by Dr. Horn, of a specimen from the Pinal Mts.

A. n. sp. near audax Horn. Pinal Mts.

LAMPYRIDÆ.

Rhyncheros sanguinipennis Say. Pinal Mts. Flying in small numbers along the banks of a roadside stream.

Lycus cruentus Lec. Riverside, Tucson.

Pyropyga fenestralis Melsh. Yuma, Tucson, Gila Bend.

Chauliognathus profundus Lec. Santa Rita Mts.

C. limbicollis Lec. Santa Rita Mts.

MALACHIIDÆ.

Collops histrio Er. Tucson.

C. pulchellus Horn. This, or a closely allied species, was taken at Riverside.

C. limbellus G. & H. Tucson, Pinal Mts., Yuma.

C. vittatus Say. Tucson. Not uncommon near water.

C. marginellus Lec. Yuma.

Pseudebæus bicolor Lec. Pinal Mts. In the oak scrub.

Attalus difficilis Lec. Pinal Mts.

CLERIDÆ.

Cymatodera cylindricollis Chevr. Tucson. At street lamps.

C. brunnea Melsh. Tucson.

C. n. sp. Santa Rita Mts.

Hydnocera discoidea Lec. Yuma.

H. sp. Tucson Mts. One other species was found in the Pinal Mts., and two in the Santa Ritas.

Aulicus nero Spin. Santa Rita Mts.

TRICHODES ILLUSTRIS Horn. A pair was found in the Santa Rita Mts., on flowers.

CLERUS SPINOLÆ Lec. Pinal Mts. Most of the specimens were found about the decaying flower-stalks of the maguey.

C. QUADRISIGNATUS Say. Yuma.

C. ABRUPTUS Lec. Santa Rita Mts.

PTINIDÆ.

PTINUS FUR Linn. Tucson.

TRIPOPITYS PUNCTATUS Lec. Pinal Mts. Mostly under boards and slabs on site of old saw-mill.

HEMIPTYCHUS sp. Pinal Mts., Tucson.

SINOXYLON SERICANS Lec. Tucson, Santa Rita Mts., Yuma.

S. SEXTUBERCULATUM Lec. Tucson.

AMPHICERUS FORTIS Lec. Yuma.

DINODERUS PUSILLUS Fabr. Tucson.

POLYCAON STOUTII Lec. Tucson. At street lights.

LYCTUS CALIFORNICUS Casey. Yuma.

LUCANIDÆ.

DORCUS MAZAMA Lec. Rather common about the sawmill in the Pinal Mts.

SCARABÆIDÆ.

CANTHON SIMPLEX Lec. Tucson Mts. The variety *corvinus* occurred at Globe.

C. INDIGACEUS Lec. Santa Rita Mts.

ATÆNIUS CALIFORNICUS Horn. Yuma.

A. GRACILIS Melsh. Riverside.

A. HAROLDI Steinh. Tucson.

A. ABDITUS Hald. Pinal Mts.

A. DESERTUS Horn. Tucson.

A. LÆVIVENTRIS Horn. Tucson. Most of the species of *Atænius* are readily attracted by light and may be found at street lamps.

BRADYCINETUS SERRATUS Lec. Tucson.

TROX SUBEROSUS Fabr. Tucson.

T. PUNCTATUS Germ. Pinal Mts.

T. TUBERCULATUS De G. Tucson.

SERICA ELONGATULA Horn. Pinal Mts., Globe.

ORSONYX ANXIUS Lec. Yuma.

DIPLOTAXIS PUBERULA Lec. Globe.

D. MŒRENS Lec. Riverside.

D. PUNCTATA Lec. Globe, Tucson.

D. PACATA Lec. Gila Bend, Tucson, Tucson Mts.

D. n. sp. Santa Rita Mts.

LISTROCHELUS TIMIDUS Horn. Tucson.

POLYPHYLLA DECEMLINEATA Say. Pinal Mts.

ANOMALA sp. Pinal Mts. This species has not been described unless it may be a Mexican form.

PELIDNOTA LUGUBRIS Lec. Tucson, Tucson Mts. During the day this insect is to be found among the leaves of various small trees. At night it comes to lights.

PLUSIOTIS GLORIOSA Lec. Pinal Mts.

COTALPA CONSOBRINA Horn. Tucson. Sometimes rather abundant about the street lights.

CYCLOCEPHALA LONGULA Lec. Tucson.

CHALEPUS OBSOLETUS Lec. Tucson. Extremely plentiful about street lamps.

APHONIDES DUNNIANUS Rivers. Tucson. Rare, being found only occasionally about lights or drowned in pools after sudden rains.

PHILEURUS ILLATUS Lec. Tucson.

ALLORHINA MUTABILIS Gory. Tucson. Abundant, and a great pest in peach orchards. I found it along the road to the Tucson Mts., feeding on the ripened fruit of Opuntia. Santa Rita Mts.

GYMNETIS SALLEI Schaum. Santa Rita Mts.

EUPHORIA FASCIFERA Lec. Tucson Mts. Two specimens were found among the branches of a small tree.

CERAMBYCIDÆ.

ERGATES SPICULATUS Lec. Pinal Mts. Several were taken in the neighborhood of the saw-mill.

MALLODON MELANOPUS Linn. Yuma.

PRIONUS CALIFORNICUS var. CURVATUS Mots. Pinal Mts.

ROMALEUM SIMPLICOLLE Hald. Tucson.

ANEFLUS LINEARIS Lec. Tucson.

DENDROBIAS MANDIBULARIS Serv. Riverside on "palo verde." Yuma, abundant on willow trees.

STENASPIS SOLITARIA Say. Santa Rita Mts., Tucson.

TRAGIDION ANNULATUM Lec. Santa Rita Mts.

T. ARMATUM Lec. Pinal Mts.

ÆTHECERUS LATECINCTUS Horn. Santa Rita Mts. On mesquite blossoms.

CROSSIDIUS INTERMEDIUS Ulke. Tucson.

C. NITIDICOLLIS Casey. Tucson.

SPHÆNOTHECUS SUTURALIS Lec. Tucson, rather common on mesquite early in July.

ISCHNOCNEMIS BIVITTATTUS Dup. A few specimens were taken on the lower slopes of the Pinal Mts., or on the roadside between our camp and Globe.

STENOSPHENUS DEBILIS Horn. Yuma.

CYLLENE ANTENNATUS White. Tucson.

OPHISTOMIS LÆVICOLLIS Bates. Santa Rita Mts. Rare.

MONILEMA ARMATUM Lec. Tucson.

PERITAPNIA FABRA Horn. Tucson Mts. A few were found under a prostrate, partially decayed *Opuntia*.

MECAS RUFICOLLIS Horn. Santa Rita Mts.

CHRYSOMELIDÆ.

EURYSCOPA LECONTEI Crotch. Pinal Mts., Tucson, Riverside.
E. PARVULA Jac. Tucson.
E. VITTATA Lec. var. Santa Rita Mts.
COSCINOPTERA ÆNEIPENNIS Lec. Road between Riverside and Tucson.
C. MUCOREA Lec. Tucson.
C. VITTIGERA Lec. A specimen from Tucson is doubtfully referred to this species.
MEGALOSTOMIS SUBFASCIATA Lec. This was met with on the lower slopes of the Pinal Mts., chiefly among bear-grass.
URODERA CRUCIFERA Lac. Found with the preceding, but in less numbers.
SAXINIS SONORENSIS Jac. Pinal Mts., in the oak zone.
BABIA 4-GUTTATA var. *4-spilota* Lec. Pinal Mts.
CHLAMYS POLYCOCCA Lac. Pinal Mts., in the oak scrub.
EXEMA CONSPERSA var. *dispar* Lec. Pinal Mts., Shady Run, Riverside.
CRYPTOCEPHALUS n. sp. Pinal Mts.
PACHYBRACHYS ABDOMINALIS Say. Pinal Mts.
P. LIVENS Lec. Tucson.
P. HEPATICUS Melsh. Globe.
P. sp., apparently new. Globe, Riverside, Tucson, Santa Rita Mts.
P. sp. A large blackish form, seemingly undescribed, was taken in the Pinal Mts.
DIACHUS AURATUS Fabr. Riverside, Pinal Mts.
XANTHONIA VILLOSULA Melsh. Pinal Mts.
MYOCHROUS LONGULUS Lec. Yuma.
PARIA CANELLA Fabr. Gila Bend, Yuma.
COLASPIS BRUNNEA Fabr. Gila Bend.
C. INTERMEDIA Jac. Tucson.
C. NIGROCYANEA Cr. Tucson.
COLASPIDEA VIRIDIMICANS Horn. Santa Rita Mts.
MYCOCORYNA LINEOLATA Stal. Riverside, Shady Run.
CHRYSOMELA TORTUOSA Rog. Tucson, Santa Rita Mts.
C. AURIPENNIS Say. Pinal and Santa Rita Mts.
PHYLLECHTHRUS SUBSULCATUS Horn. Santa Rita Mts.
ANDRECTOR RUFICORNIS Oliv. Tucson.
TRIARIUS LIVIDUS Lec. Pinal and Santa Rita Mts.
T. TRIVITTATUS Horn. Pinal Mts.
DIABROTICA TENELLA Lec. Yuma.
HEMIPHRYNUS INTERMEDIUS Jac. Pinal Mts.
DISONYCHA CRENICOLLIS Say. Riverside.
SYSTENA BITÆNIATA Lec. Yuma.
LONGITARSUS REPANDUS Lec. Yuma.
CHÆTOCNEMA ECTYPA Horn. Yuma.

BRUCHIDÆ.

BRUCHUS PROSOPIS Lec. Tucson, Gila Bend.
B. AMICUS Horn. Tucson, Santa Rita and Pinal Mts.

B. placidus Horn. Santa Rita Mts.
B. n. sp., near bivulneratus Horn. Santa Rita Mts.
B. n. sp., near fraterculus Horn. Riverside.
Zabrotes spectabilis Horn. Riverside.
Z. n. sp. Pinal and Santa Rita Mts.

TENEBRIONIDÆ.

Edrotes ventricosus Lec. Casa Grande, under logs.
Triorophus lævis Lec. Riverside, Tucson, Tucson Mts., Gila Bend. Often rather abundant under logs and when fresh is covered with a bluish bloom.
Trimitys sp. Globe.
Eurymetopon rufipes Esch. Yuma.
E. emarginatum Casey. Tucson, Riverside.
E. perforatum Casey. Tucson.
Emmenastes subopacus Horn. Tucson, Tucson Mts., Riverside.
E. longulus Lec. Riverside, Tucson, Yuma.
E. obtusus Lec. Tucson.
Epitragus submetallicus Lec. Tucson.
E. pruinosus Horn. Tucson.
Zopherus tristis Lec. Riverside, Tucson.
Dacoderus striaticeps Lec. Tucson. Very rare under boards.
Aræoschizus fimbriatus Casey. Tucson.
A. simplex Casey. Tucson.
A. regularis Horn. Tucson. The species of this genus occur, sometimes in large colonies, on the under sides of boards. A more northern form (*A. armatus*) has been taken in ants' nests.
Cryptoglossa verrucosa Lec. Tucson, Gila Bend, Yuma.
Centrioptera variolosa Horn. Tucson.
Ologlyptus anastomosis Say. Tucson, Globe, chiefly under dead yucca or other thick-stemmed plants.
Asida confluens Lec. Gila Bend.
A. wickhamii Horn. Tucson Mts., Pinal Mts., under dead yuccas.
A. macra Horn. Pinal Mts., in the pine zone near site of old saw-mill.
Eusattus reticulatus Say. Pinal Mts.
Eleodes carbonaria Say. Pinal Mts.
E. humeralis Lec. Tucson Mts., Pinal Mts.
E. extricata Say. Pinal Mts.
E. armata Lec. Tucson, Yuma, Gila Bend.
E. longicollis Lec. Tucson.
E. gentilis Lec. Pinal Mts.
E. eschscholtzii Sol. (=*wickhamii* Horn). Tucson Mts.
E. gracilis Lec. Pinal Mts.
Embaphion contusum Lec. Pinal Mts.
Argoporis sulcipennis Lec. Santa Rita Mts.
A. bicolor Lec. Tucson Mts., Gila Bend, Riverside, Yuma.
Amphidora caudata Horn. Casa Grande.

Nyctobates subnitens Horn. Santa Rita Mts.
Iphthimus sublævis Bland. Pinal Mts.
Cœlocnemis punctata Lec. Pinal Mts.
Adelina lecontei Horn. Tucson, Yuma.
Alæphus macilentus Casey. Tucson.
Eupsophus castaneus Horn. Pinal Mts.
Mecysmus angustus Lec. Pinal Mts.
Blapstinus sordidus Lec. Riverside, Shady Run.
B. dilatatus Lec. Riverside, Shady Run.
B. brevicollis Lec. Riverside.
B. intermixtus Casey. Pinal Mts.
Notibius puberulus Lec. Yuma.
N. substriatus Casey. Tucson.
N. puncticollis Lec. Tucson.
N. granulatus Lec. Tucson, Gila Bend.
Conibiosoma laciniata Casey. Tucson.
Ammodonus fossor Lec. Tucson, about street lights.
Tribolium ferrugineum Fabr. Riverside, Santa Rita Mts.
Aphanotus brevicornis Lec. Tucson.
Alphitobius piceus Oliv. Tucson.
Ulosonia marginata Lec. Tucson.
Cynæus depressus Horn. Yuma.
Helops arizonensis Horn. Tucson, Santa Rita Mts.

CISTELIDÆ.

Hymenorus confertus Lec. Pinal and Santa Rita Mts.
H. punctatissimus Lec. Tucson.
H. apacheanus Casey. Gila Bend.

MONOMMIDÆ.

Hyporhagus gilensis Horn. Pinal Mts., Shady Run, Tucson. Found under stems of yucca, sometimes abundantly.

MELANDRYIDÆ.

Carebara longula Lec. Pinal Mts., about sawed lumber.
Eustrophus sp., near tomentosus Say. Tucson.
Mycterus concolor Lec. Pinal Mts.

ŒDEMERIDÆ.

Oxacis sp. Pinal Mts.

MORDELLIDÆ.

Mordella scutellaris Fabr. Santa Rita Mts.
Mordellistena tosta Lec. Yuma.

ANTHICIDÆ.

Notoxus bifasciatus Lec. Pinal Mts.
Mastoremus longicornis Casey. Pinal Mts.

BAULIUS TENUIS Lec. Yuma.

LAPPUS BIPARTITUS Casey. Yuma.

L. VIVIDUS Casey. Tucson, Pinal Mts.

L. PINALICUS Casey. Pinal Mts.

HIMANTUS FLORALIS Linn. Tucson.

VACUSUS CONFINIS Lec. Tucson, Riverside.

ANTHICUS NANUS Lec. Pinal Mts.

A. BELLULUS Lec. Pinal Mts., Riverside.

A. LUTEOLUS Lec. Yuma.

MELOIDÆ.

NEGALIUS MARMORATUS Casey. Tucson. One or two specimens were found at large.

NEMOGNATHA IMMACULATA Say. Santa Rita Mts.

PYROTA MYLABRINA Chev. Tucson. Much less common than it appears to be in southern New Mexico, where it often abounds on golden-rods during August.

P. AKHURSTIANA Horn. Tucson. Rather rare at street lights.

MACROBASIS LAUTA Horn. Tucson.

M. TENELLA Lec. Tucson. This and the preceding species occur sparingly at street lamps.

EPICAUTA n. sp., near LEMNISCATA Fabr. Yuma.

CANTHARIS DESERTICOLA Horn. Santa Rita Mts. The only specimen seen was flying, during the afternoon.

RHYNCHITIDÆ.

EUGNAMPTUS COLLARIS Fabr. Pinal Mts., in the oak scrub.

OTIORHYNCHIDÆ.

EPICÆRUS IMBRICATUS Say. Pinal Mts. The species of this genus need revision and it is possible that a renewed study will show that the form here referred to is distinct from *imbricatus*.

OPHRYASTES VITTATUS Say. Globe.

EUPAGODERES ARGENTATUS Lec. Tucson. Extremely abundant.

E. SORDIDUS Lec. Santa Rita Mts.

E. VARIUS Lec. Tucson.

EUCYLLUS VAGANS Horn. Gila Bend, Casa Grande. Occurs under boards or logs in very dry sandy spots.

RHYPODES n. sp. Tucson, Gila Bend.

CYPHUS LAUTUS Lec. Santa Rita Mts.

PHACEPHOLIS ELEGANS Horn. Tucson. On mesquite.

COLEOCERUS MARMORATUS Horn. Tucson, abundant on mesquite and other Leguminosæ.

CURCULIONIDÆ.

APION SORDIDUM Smith. Tucson, Riverside.

A. ŒDORHYNCHUM Lec. Pinal Mts.

A. VENTRICOSUM Lec. Yuma, Tucson, on *Prosopis*.

A. PROCLIVE Lec. Pinal Mts.

A. VARICORNE Smith. Yuma.

A. CARINIROSTRUM Fall. (MS.). Santa Rita Mts.

DINOCLEUS DENTICOLLIS Casey. Globe. The species of this genus are found about the roots of various weeds in sandy spots.

D. SAGINATUS Casey. Tucson.

D. MOLITOR Lec. Yuma.

DORYTOMUS INÆQUALIS Casey. Riverside.

DESMORIS CONSTRICTUS Say. Tucson.

SMICRONYX RUFULUS Dietz. Riverside.

S. SPURCUS Casey. Tucson.

SYNERTHA IMBRICATA Casey. Pinal Mts., Riverside

S. WICKHAMII Dietz. Riverside.

ENDALUS LIMATULUS Gyll. Tucson.

MAGDALIS LECONTEI Horn. Pinal Mts.

ANTHONOMUS sp. Yuma.

TYCHIUS SETOSUS Lec. Yuma.

T. HISPIDUS Casey. Santa Rita Mts.

T. SYBINIOIDES Casey. Santa Rita Mts. The small western species of this genus are mostly found upon the various arborescent Leguminosæ. characteristic of arid areas.

CONOTRACHELUS SENICULUS Boh. Tucson. The name is from Dr. Horn.

RHYSSEMATUS MEDIALIS Casey. Tucson.

ZYGOPS SEMINIVEUS Lec. Foothills of the Pinal Mts. Common on the maguey, chiefly near base of flower-stalk.

PIAZURUS CALIFORNICUS Lec. Pinal Mts., Tucson, Yuma.

COPTURUS ADSPERSUS Lec. Yuma.

TACHYGONUS CENTRALIS Lec. Pinal Mts.

ONYCHOBARIS EGENA Casey. Pinal Mts.

O. AMBIGUA Casey. Tucson.

O. MYSTICA Casey. Foot hills of Pinal Mts., on a narrow-stemmed cactus. Globe.

CENTRINUS SENILIS Gyll. Santa Rita Mts.

C. HOSPES Casey. Tucson

CALANDRIDÆ.

SCYPHOPHORUS ACUPUNCTATUS Gyll. Pinal and Santa Rita Mts., in maguey stalks.

RHODOBÆNUS TREDECIMPUNCTATUS Ill. Tucson.

COSSONUS CRENATUS Horn. Pinal Mts., under pine bark.

SCOLYTIDÆ.

PLATYPUS n. sp. Pinal Mts.

PITYOPHTHORUS NITIDULUS Lec. Pinal Mts.

XYLEBORUS XYLOGRAPHUS Say. Pinal Mts.

TOMICUS CONFUSUS Lec. Pinal Mts.

DENDROCTONUS TEREBRANS Oliv. Pinal Mts.

HYLASTES GRACILIS Lec. Pinal Mts.

Fred J Seave

PRICE, FIFTY CENTS.

VOL. IV. NO. 4.

BULLETIN

FROM THE

LABORATORIES OF NATURAL HISTORY

OF THE

STATE UNIVERSITY OF IOWA.

I. THE IOWA SEDGES, ... R. I. CRATTY.

II. DESCRIPTIONS OF AMERICAN UREDINEÆ, II, . . J. C. ARTHUR AND E. W. D. HOLWAY

PUBLISHED
BY AUTHORITY OF THE REGENTS.

IOWA CITY, IOWA:
DECEMBER, 1898.

Vol. IV. No. 4.

BULLETIN

FROM THE

LABORATORIES OF NATURAL HISTORY

OF THE

STATE UNIVERSITY OF IOWA.

PUBLISHED

BY AUTHORITY OF THE REGENTS.

IOWA CITY, IOWA:
DECEMBER, 1898.

Secretary Wm. J. Haddock:

I take pleasure in submitting herewith Bulletin No. 4, of Volume IV, from the Laboratories of Natural History, of the State University of Iowa.

T. H. Macbride. *Editor.*

December, 1898.

EDITORIAL STAFF.

Geology, ...	S. Calvin.
Botany, ...	T. H. Macbride.
Zoology, ...	C. C. Nutting.

LIBRARY
NEW YORK
BOTANICAL
GARDEN

THE IOWA SEDGES.

BY R. I. CRATTY.

THE *Cyperaceæ* or *Sedge Family* includes about one-twelfth of the flowering plants found within the limits of our state. It comprises about 65 genera and 3.000 species of wide geographical distribution but most numerous in the north temperate zone. Of the 20 genera found in the northern United States and Canada, 10 are known to occur in Iowa, and it is probable that two others, *Cladium* and *Rhynchospora*, will yet be found.

The sedges have solid stems which are usually triangular, the sheaths of the leaves being closed. The flowers, which are arranged in spikes or spikelets, are in the axils of single scales, the perianth none, or replaced by bristles in *Eriophorum*, *Dulichium*, and in most species of *Eleocharis* and *Scirpus*. The fruit is a triangular or lenticular akene, which in the genus *Carex* is inclosed in a sac, technically called a perigynium.

There is found in Iowa very nearly the same number of species belonging to each of the two great families, the *Cyperaceæ* and the *Gramineæ*, but in the number of individual plants the former is very greatly out-numbered by the latter. This disparity, so noticeable in our original flora, is being increased every year as the introduced and cultivated grasses are rapidly taking the place of the sedges on all tillable and closely pastured land.

Those species of sedge, belonging principally to the genus *Carex*, found on upland prairies and in the woods are of considerable economic value for pasturage, but on the open lands are usually so mature at the time the native grasses are ready to be mowed as to be of little value for hay. If closely pas-

JUN 25 1915

tured the upland prairie sedges are quickly destroyed, but those found in the woods where the shaded ground retains moisture better, survive much longer.

When we consider the great number of species in the sedge family, and their wide geographical distribution, it is remarkable that an introduced foreign species is so rarely met, there being but a very few in the United States, and so far as known, not one within the limits of Iowa. Compared with the *Gramineæ* in this respect the difference is very striking. The troublesome introduced grasses of our state are, with one or two exceptions, annuals, and all well fitted by nature for the rapid dissemination of their seed into new localities by man's agency as he carries on his agricultural operations, even though he may do his best to prevent it. The carices which comprise much the greater part of the sedge flora of the land suitable for cultivation being perennials are ill fitted to survive where the soil must be frequently turned by the plow, but in *Cyperus esculentus* L. we have at least one exception, which on account of its numerous, small tubers is able to live in low cultivated land, and is troublesome in some localities.

In the distribution of our native plants into new localities by natural agencies the wind is a very important factor, but with the exception of a few species the distribution of the sedges by this means is comparatively slow. The fruit of such plants, however, as the species of *Eriphorum*, is quite well fitted for rapid distribution by high winds. The seeds of most of our *Compositæ* and many other plants which mature late in autumn, are often carried great distances over the crusted snow by the strong winter winds, but the fruit of the sedges, with very few exceptions, is not retained on the plants long enough to avail of this latter means of transportation. To the action of waves on our ponds and lakes, and to the currents of streams, especially during high water, we must attribute much credit for the distribution of the seeds of sedges. This is especially true of those carices having an inflated perigynium which are thus enabled to float very readily. An equal amount of credit is perhaps due to the birds, especially to the migratory water-fowl, which pass over the state in great numbers every spring and autumn. The small and very numerous seeds of the species of *Cyperus*, *Eleocharis*, and other shore-loving sedges fall soon after maturity, and mingling with the sand and mud on the shores of lakes and streams may very readily adhere to the feet and legs of these birds and be carried by them long distances in their migrations, while the akenes of many of the larger fruited sedges when eaten by the birds are undoubtedly protected by the indurated seed-coats which are characteristic of the plants of this family.

Those species of sedges which delight in very wet situations seldom flower or fruit except under normal conditions of moisture. The author has observed several species of *Carex* remaining unfruitful under unfavorable conditions for a period of from five to ten years.

The sedge flora of Iowa is characteristically eastern and corresponds quite closely with that of the bordering states, and though lying just east of the great plains, but one species, *Carex stenophylla* Wahl. has yet been found which does not occur east of the Mississippi River. The richest portion of the state in sedges is that bordering on this great water-way. This may be accounted for partly because of the greater diversity of soil, surface, woodland, and prairie in that region, and partly because the natural agencies for the distribution of seeds, and the greater rainfall combine to favor that portion of the state.

In the preparation of this paper over one thousand specimens, comprising several times that number of individual plants, have been examined, representing all portions of the state, especially the eastern-central, and northern portions which have been the most thoroughly explored. The region from Sioux City to the southwestern corner of the state is the poorest represented in the citations, and it is in this region that additional western species are to be the most confidently expected.

Of the species herein listed 15 are annuals, divided among the genera as follows: *Cyperus*, 7; *Eleocharis*, 4; *Stenophyllus*, 1; *Fimbristylis*, 1; *Scirpus*, 1; and *Hemicarpha*, 1, The remaining species of these and all the other genera are perennials.

The classification followed is that of Britton and Brown's *Illustrated Flora* (1896-7). The names used in *Gray's Manual*, 6th edition, and in previously published lists, when different, are given in the synonymy. In this order, however, the changes made are comparatively few.

In the study of the material at my command I have been greatly aided by having access to several sets of plants determined by Prof. L. H. Bailey, of Cornell University, Ithaca, New York, and by Dr. N. L. Britton, of Columbia University, New York City. The former gentleman has at various times greatly aided me by the determination of carices and by the exchange of specimens.

My thanks are also here tendered to the following persons for specimens and other assistance: Prof. B. Shimek, of the Iowa State University for collections made in various parts of the state; Prof. Bruce Fink, of Upper Iowa University, at Fayette, for a set of the sedges of that region; Prof. L. H. Pammel, of the Iowa Agricultural College, for the privilege of studying the *Cyperaceæ* in the herbarium of that institution, for extensive collections made in various parts of the state, and for the loan of literature; Messrs. Wm. D. Barnes, of Blue Grass, and A. A. Miller, of Eldridge, Scott County, two most excellent collectors, for sedges from that region and for many valuable notes regarding soil, distribution, etc.; Prof. T. J. Fitzpatrick, of Graceland College, Lamoni. for specimens from Decatur County and from other localities; Prof. H. W. Norris and Frank W. Johnson, of Iowa College, Grinnell, for the loan of their private collections and a portion of the college herbarium; Dr. J. C. Arthur, of Purdue University, Lafayette, Indiana, for data and the loan of specimens; Prof. T. H. Baldwin, of Tabor, Iowa, for specimens of his own collection and a list of the sedges, with the accompanying data, in the Arthur collection exhibited at the Centennial Exposition, and now the property of Tabor College. My thanks are also due to numerous collectors whose names appear in the citations. For numerous kind favors I am also indebted to Prof. T. H. Macbride, of the Iowa State University, at whose request this paper is prepared.

It is felt that this catalogue is necessarily incomplete, there being so large an area of the state which has not yet been thoroughly explored. The acknowledged difficulty of this group of plants has caused them to be neglected more than the higher Phanerogams, but the rapid conversion of nearly the whole area of the state into pastures or cultivated fields should incite those interested in our indigenous flora to secure specimens for preservation with as little delay as possible. Mature fruiting specimens of this group of plants from new localities or of species not herein listed are solicted by the author that they may be studied and published in future lists, full credit for which will be given.

The table here appended gives the extent in genera and the number of species and varieties of sedges listed in the following local and state catalogues:

	GEN.	SP. & VARS.
Bessey, Cont. Fl. Iowa,	5	21
Arthur, Fl. Iowa and Add.,	9	92
Hitchcock, Plants of Ames,	6	219
Upham, Flora of Minnesota,	10	129
MacMillan, Metas. Minn. Val.,	11	97
Brendel, Flora Peoriana,	10	125
Tracy, Flora of Missouri,	11	102
Higby and Raddin, Fl. Cook Co., Ills.,	11	116
Beal and Wheeler, Flora of Michigan,	13	206
Beardslee, Cat. Pl. Ohio,	12	120
Wheeler, Fl. Milwaukee Co., Wis.,	7	37
Flagg and Burrill, Ill. Plants,	13	153
Bot. Gaz., Flora of Indiana,	12	108
Bruhin, Flora of Wisconsin,	10	105
Rydberg, Fl. Sand Hills, Neb.,	6	33
Webber, Fl. Neb. and Rep. I-IV,	9	78
Rydberg, Fl. Black Hills, S. D.,	4	28
Williams, Grasses and Forage Pl., Daks.,	5	33
Swezey, Neb. Flow. Plants,	5	29
Fink, Flora, Fayette, Iowa,	5	34

CYPERACEÆ.

CYPERUS *L.* Sp. Pl., 44 (1753).

A very large genus of annual and perennial sedges, widely distributed in tropical and temperate regions. The species are of little economic value, furnishing a small percentage of inferior pasturage along the margins of ponds and streams and on marshy land.

Species about 650.

Illustrated Flora, 32; Gray's Manual, 6th ed., 25; MacMillan, Metas. Minn. Valley, 9; Arthur, Flora of Iowa, 8; Tracy, Flora of Missouri, 16; Brendel, Flora Peoriana, 9; Webber, Flora of Nebraska, and Rep. I-IV, 11; Williams, Grasses and Forage Plants of the Dakotas, 4; Fink, Flora of Fayette, Iowa, 6.

1. C. DIANDRUS *Torr.* Cat. N. Y., 90 (1819).

Illus. Flora, I. 236, fig. 544; Gray's Man., 6th ed., 569; Hitchcock, Pl. Ames 523; MacMillan, Metas. Minn. Val., 93; Tracy, Fl. Missouri, 90; Brendel, Fl. Peoriana, 61; Wheeler, Fl. Milwaukee Co., Wis., 186; Rydberg, Fl. Sand Hils, Neb., 184; Fink, Iowa Acad. Sci., IV, 105.

Low ground, sandy shores of streams and lakes. Probably throughout the state but not common. Quite variable, closely approaching the next species in some forms.

Muscatine and Ames, *Hitchcock;* Decorah, 1881, *Holway;* Fremont County, 1894, *Fink;* Clinton County, 1896, *Pammel;* Moscow, 1894, *Barnes & Miller;* Grinnell, Aug., 1886, *Johnson.*

2. C. RIVULARIS *Kunth.* Enum., II, 6 (1837).

C. diandrus var. *castaneus* Torr., Ann. Lyc. N. Y., III, 252 (1836), not Willd. (1798).

Illus. Flora, I, 236, Fig. 545; Gray's Man., 6th ed., 569; Arthur, Fl. Iowa, 33; Hitchcock. Pl. Ames, 523; MacMillan, Metas. Minn. Val., 93; Webber, App. Fl. Neb., 24; Fink, Iowa Acad. Sci. IV, 105.

Same situations as the last. Varies from a couple of inches to over a foot in height. A beautiful species, the bright, chestnut-colored scales very conspicuous.

Ames, 1875, *Arthur;* Lawler, 1890, *Rolfs;* Emmet and Dickinson counties, various collections, *Cratty;* Woodbine, 1874, *Burgess;* Scott and Muscatine counties, frequent, *Barnes & Miller;* Charles City, Aug., 1875, *Arthur.*

3. C. INFLEXUS *Muhl.* Gram., 16 (1817).

C. aristatus Boeckl. Linnæa, XXXV, 500 in part (1868), not Rottb., Desc. & Icon., 23 (1773).

Illus. Flora, I, 273, fig. 549; Gray's Man., 6th ed., 507; Arthur, Cont. Fl. Iowa, II; Hitchcock, Pl. Ames, 523; MacMillan, Metas. Minn. Val., 93; Tracy, Fl. Missouri, 91; Brendel, Fl. Peoriana, 61; Hale, Add. Fl. Wis., 5; Rydberg, Fl. Sand Hills, Neb., 184; Rydberg, Fl. Black Hills, S. D., 526; Fink, Iowa Acad. Sci., IV, 105.

Sandy margins of streams and ponds; throughout. The long, tapering, recurved points of the scales readily distinguish this from any of our other species.

Story county, 1886, and Iowa City, 1887, *Hitchcock;* Emmet county, 1884, and Dickinson county, 1896, *Cratty;* Hamilton county, 1891, *Rolfs;* Fayette county, 1894, *Fink;* Clinton county, 1896, *Pammel;* Johnson county, 1894, *Fitzpatrick;* Nora Springs, July, 1889, and Clear Lake, 1889, *Johnson;* Scott and Muscatine counties, *Barnes & Miller;* Ames, Sept., 1897, No. 444, *C. C. Ball.*

4. C. SCHWEINITZII *Torr.* Ann. Lyc. N. Y., III, 276 (1836).

Illus. Flora, I, 238, fig. 551; Gray's Man., 6th ed., 597; Arthur, Fl. Iowa, 33; Hitchcock, Pl. Ames, 523; MacMillan, Metas. Minn. Val., 92; Tracy, Fl. Missouri, 91; Brendel, Fl. Peoriana, 88; Bruhin, Fl. Wis., 278; Rydberg, Fl. Sand Hills, Neb., 183; Williams, Grass and Forage Pl. Daks., 41; Fink, Iowa Acad. Sci., IV, 105.

Sandy margins of streams and lakes; quite variable. Common, at least through the northern half of the state.

Charles City, July, 1872, *Arthur;* Marshalltown, 1891, *Stewart;* Ames, 1889, *Hitchcock;* Newton, 1891, *Drew;* Cedar Rapids, 1891, *Pammel;* Emmet county, 1882, and Spirit Lake, 1896, *Cratty;* Fremont county, 1888, *Hitchcock;* Fayette county, 1894, *Fink;* Johnson county, *Fitzpatrick;* Lynville, Jasper county, July, 1888, *Norris;* Scott and Muscatine counties, *Barnes & Miller.*

5. C. ACUMINATUS *Torr. & Hook.* in Torr. Cyp. 435 (1836).

Illus. Flora, I, 239, fig. 553; Gray's Man., 6th ed., 570; Arthur, Cont. Fl. Iowa, IV; Tracy, Fl. Mo., 90; Brendel, Fl. Peoriana, 61; Bruhin, Zwei. Nach. Fl. Wis., 643; Webber, App. Fl. Neb., 24; Rydberg, Fl. Black Hills, S. D., 526.

Margins of streams; well distributed throughout the state, but not common.

Woodbury county and Sioux City, 1888, *Hitchcock;* Oquawka, Ills., *Patterson;* Banks of Wapsipinicon, Scott county, July, 1896, and Folletts, Clinton county, *Barnes & Miller;* Plymouth county. *Arthur*, l. c.; Montrose, 1883, *Ehinger;* Jefferson county, 1897, No. 455, *Baldwin.*

6. C. ESCULENTUS *L.* Sp. Pl., 45 (1753). Pl. I.

Illus. Flora, I, 241, fig. 559; Gray's Man., 6th ed., 571; Arthur, Fl. Iowa, 33; Hitchcock, Pl. Ames, 523; MacMillan, Metas. Minn. Val., 92; Tracy, Fl. Mo., 91; Brendel, Fl. Peoriana, 61; Hale, Add. Fl. Wis., 5; Webber, Fl. Neb., 99; Fink, Iowa Acad. Sci., IV, 105.

Central, eastern and southern portions of the state. The narrow, many flowered spikelets are straw-colored when mature, the leaves a lighter green than those of *C. strigosus* or *C. specsiosus.* Propagated by its small, edible tubers which make it occasionally troublesome in low, cultivated fields.

Charles City, July, 1875, *Arthur;* Iowa City and Ames, 1889, *Hitchcock;* Marshalltown, 1891, *Stewart;* Fayette county, 1893, *Fink;* Clinton county, 1896, *Pammel;* Clayton county, June, 1895, *Fitzpatrick;* Scott and Muscatine counties, where it is rather frequent in cultivated fields, *Barnes & Miller;* Peru, June 20, 1897, No. 452, *Hollingsworth;* Libertyville, 1897, *Baldwin;* Mt. Pleasant, Oct. 1, 1897, *Dr. Mitte.*

7. C. ERYTHRORHIZOS *Muhl.* Gram., 20 (1817). Pl. I.

Illus. Flora, I. 241, fig. 560; Gray's Man., 6th ed., 571; Hitchcock, Pl. Ames, 523; MacMillan, Metas. Minn. Val., 92; Tracy, Fl. Mo., 91; Brendel, Fl. Peoriana, 61; Bruhin, Fl. Wis., 278; Williams, Grass. and For. Pl. Dakotas, 41.

Probably throughout the state; banks of streams and margins of lakes. Not before reported from Iowa. The linear spikelets of many very small flowers with their bright, chestnut-colored scales are very pretty objects under the lens.

Estherville, bank of Des Moines River, 1881, *Cratty;* Story county and Iowa City, *Hitchcock;* Clinton county, 1896, *Pammel;* Scott and Muscatine counties, *Barnes & Miller;* Iowa Lake, 1897, *Pammel & Cratty.*

8. C. SPECIOSUS *Vahl.* Enum., II, 364 (1806).

C. michauxianus Gray, Man., 5th ed., 554 (1867), not of Schultes (1824).

Illus. Flora, I, 242, fig. 562; Gray's Man., 6th ed., 572; Arthur, Fl. Iowa, 33; MacMillan, Metas. Minn. Val., 91; Tracy, Fl. Mo., 91; Bessey, Cont. Fl. Iowa, 123; Brendel, Fl. Peoriana, 61; Hale, Add. Fl. Wis., 5; Webber, Fl. Neb., 99; Williams, Grass. and For. Pl. Dakotas, 41.

Low grounds, marshes and margins of streams and ponds. Throughout the state; variable. In marshes often 2 feet high; not as handsome in the dried specimen as many other species of the genus. Within our limits it is often found associated with *C. erythrorhizos*.

Iowa City, *Hitchcock;* Woodbine, 1874, *Burgess;* Davenport, 1889, *Hitchcock;* Grinnell, 1886, Johnson. Scott and Muscatine counties, 1896, *Barnes & Miller;* South shore of Iowa Lake, Emmet county, Aug. 27, 1897, *Cratty;* Clinton county, 1896, *Pammel;* Decatur county, 1897, *Fitzpatrick;* Creston, Sept. 13, 1897, No. 464, *E. P. Bettenga;* Libertyville, 1897, *Baldwin.*

NOTE.—*C. engelmanni* Steud., Syn. Pl. Cyp. 47 (1853), has been reported from Iowa, but I have been unable to find any specimen of this species in any collection in the state. It is reported by Wheeler in Fl. Milwaukee Co., Wis., 186; by Tracy in Fl. Mo, 90; by Brendel in Fl Peoriana, 88, and by Webber in Fl. Neb., 95. It probably occurs in the southern part of the state, and can be distinguished from the above, to which it is closely related, by its more slender spikelets, and the tips of the scales not reaching to the succeeding one on the same side.

9. C. STRIGOSUS *L.* Sp. Pl., I, 47 (1753).

Illus. Flora, I, 243, fig. 565; Gray's Man. 6th ed., 571; Arthur, Fl. Iowa, 33; Hitchcock, Pl. Ames, 523; MacMillan, Metas. Minn. Val., 91; Tracy, Fl. Mo., 91; Brendel, Fl. Peoriana, 61; Wheeler, Fl. Milwaukee Co., Wis., 186; Rydberg, Fl. Sand Hills, Neb., 183; Fink, Iowa Acad. Sci., IV, 105.

Our commonest and most variable species in low, wet ground, growing from a few inches to two or three feet in height. Perennial by basal corm-like tubers.

Grinnell, Aug., 1884, *Norris, Johnson;* Iowa City, *Hitchcock;* Cedar Rapids, 1891, *Pammel;* Muscatine, *Reppert;* Emmet county, 1896, and Kossuth county, 1897, *Cratty;* Decatur county, Sept., 1896, *Fitzpatrick;* Scott and Muscatine counties, 1896, *Barnes & Miller;* Charles City, Aug., 1875, *Arthur;* Muscatine, 1897, *Ball.*

The following varieties also occur, in Iowa, specimens of each, determined by Dr. N. L. Britton being in the herbarium of the Iowa Agricultural College at Ames.

10. C. STRIGOSUS ROBUSTIOR *Kunth.* Enum., II, 88 (1837).

Illus. Flora, I, 243.

Habit and range of the type, but less common. Spikelets nearly an inch long, 10-25 flowered.

Ames and Iowa City, *Hitchcock;* Woodbine, 1878, *Burgess.*

11. C. STRIGOSUS CAPITATUS *Boeckl.* Linnæa, XXXVI, 347 (1869–70).

Illut. Flora, I, 243.

Low ground in marshes, rare; not before reported from the state. A very small, slender form, the plants only a few inches tall with the 5–15 flowered spikelets arranged in capitate clusters. It is possible that this is merely a state of the type produced by a very dry season.

Algona, *Hitchcock;* Emmet county, in a marsh 1½ miles east of Armstrong, Aug., 1896, *Cratty.*

12. C. STRIGOSUS COMPOSITUS *Britton.* Bull. Torr. Club, XIII, 212 (1886).

Illus. Flora, I, 243.

Rather rare in swamps or low ground. The umbel very compound, the 4–6 flowered spikelets clustered in cylindrical heads. Plants 6–18 inches high.

Charles City, *Arthur;* Lawler, 1890, *Rolfs;* Scott county, *Barnes & Miller;* Iowa Lake, Emmet county, Aug., 1897, *Cratty.*

13. C. FILICULMIS *Vahl.* Enum., II, 328 (1806).

Illus. Flora, I, 245, fig. 571; Gray's Man., 6th ed., 570; Arthur, Fl. Iowa, 33; Hitchcock, Pl. Ames, 523; MacMillan, Metas. Minn. Val., 92; Tracy, Fl. Mo., 91; Brendel, Fl. Peoriana, 61; Bruhin, Fl. Wis., 278; Webber, Fl. Neb., 99; Fink, Iowa Acad. Sci., IV, 105.

Sandy soil, margins of streams and lakes; most frequent in the eastern half of the state. Quite variable.

Ames, 1889, *Hitchcock;* Charles City, 1875, *Arthur;* Cedar Rapids, 1891, *Pammel;* Iowa City, *Hitchcock;* La Crosse, Wis., *Pammel;* Fayette county, 1894, *Fink;* Clinton, 1895, *Pammel;* Cedar Rapids, a peculiar form in general appearance approaching *C. schweinitzii* Torr., *Hitchcock;* Scott and Muscatine counties *Barnes & Miller;* Hancock county, 1881, *Ehinger;* Johnson county, July 15, 1897, *Shimek;* Muscatine Island, Louisa county, Aug. 1, 1897, *Meyers;* Belmond, 1897, *Pammel.*

DULICHIUM *L. C. Richards.* Pers. Syn., I, 65 (1805).

A monotypic genus of the eastern half of North America.

1. D. ARUNDINACEUM (*L.*) *Britton.* Bull. Torr. Club, XXI, 29 (1894).

D. spathaceum, Pers., Syn., I, 65 (1805).

Illus. Flora, I, 247, fig. 576; Gray's Man., 6th ed., 573; Arthur, Fl. Iowa, 33; MacMillan, Metas. Minn. Val., 90; Tracy, Fl. Mo., 91; Brendel, Fl. Peoriana, 61; Wheeler, Fl. Milwaukee Co., Wis., 186; Webber, App, Fl. Neb., 24.

Low, wet places; central and eastern portions of the state; rather rare.

Ames, June, 1871, *Arthur;* Story county, *Hitchcock;* La Crosse, Wis., *Pammel.* In bogs along Skunk River, Jasper county, July 3, 1886, *Johnson;* Moscow, Muscatine county, 1893, and Noels, Scott county, 1894, *Barnes & Miller.*

ELEOCHARIS *R. Br.* Proc. Nov. Hol., I, 209 (1810).

Sedges with simple, leafless culms, bearing single capitate or elongated spikes, the akene surmounted by a tubercle and usually subtended with bristles. Annuals or perennials, abounding in water or wet situations.

Species about 100.

Illus. Flora, 22; Gray's Man., 6th ed., 21; MacMillan, Metas. Minn. Val., 7. Arthur, Fl. Iowa, 5; Tracy, Fl. Mo., 6; Brendel, Fl. Peoriana, 5; Webber, Fl. Neb. and Rep. I–IV, 6; Fink, Fl., Fayette, Iowa, 3.

1. E. ATROPURPUREA (*Retz.*) *Kunth.* Enum. II, 151 (1837).

Illus. Flora, I, 250, fig. 582; Webber, App. Fl. Neb., 24; Dr. Britton in Torr. Bull. XVIII, 166.

A widely distributed species of the southern United States and tropical America.

Found growing in wet sand at Fruitland, Muscatine county, by Mr. Reppert. The plant is about 2½ inches high, the culms wiry, the spikes ovoid, 1½ lines long by 1 line wide. It resembles the eastern *E. olivacea* Torr. but grows from an annual root. Probably very rare within our limits; not before reported from Iowa. Mr. Wm. D. Barnes who communicated the plant to me cites this as a probable example of a southern plant brought to us by the agency of migratory water-fowl which resort to that locality in great numbers.

2. E. OVATA (*Roth.*) *R. & S.* Syst., II, 152 (1817).

E. obtusa Schultes, Mont., II, 89 (1824).

Illus. Flora, I, 251, fig. 584; Gray's Man., 6th ed., 574; Arthur, Cont. Fl. Iowa, IV; MacMillan, Metas. Minn. Val., 102; Tracy, Fl. Mo., 91; Brendel, Fl. Peoriana, 61; Bruhin, Fl. Wis., 278; Webber, Fl. Neb., 99; Fink, Iowa Acad. Sci., IV, 105.

Wet soil, southern and eastern portions of the state. Very variable in regard to height, and size of the spikes.

Ames and Iowa City, *Hitchcock;* Kellogg, 1877, collector unknown; Keokuk, *Hitchcock;* Fayette county, 1894, *Fink;* Moscow, 1894, *Barnes & Miller;* Appanoose county, July, 1896, and Decatur county, Aug., 1898, *Fitzpatrick;* Grinnell, June, 1894, *Johnson;* Peru, July 20, 1897, No. 393, *Hollingsworth;* Birmingham, Aug. 15, 1897, *Baldwin.*

NOTE.—*E. engelmanni* Steud., Syn. Pl. Cyp., 79 (1855), (*E. obtusa* var. *detonsa* Gray) has been collected on the Mississippi bottoms at Oquawka, Ill., by Mr. H. N. Patterson, and probably occurs in the southeastern part of the state. It is also reported from Kansas by Smythe.

3. E. PALUSTRIS (*L.*) *R. & S.* Syst., II, 151 (1817).

Scirpus palustris L. Sp. Pl. 47 (1753).

Illus. Flora, I, 251, fig. 586; Gray's Man., 6th ed., 575; Arthur, Fl. Iowa, 33; Hitchcock, Pl. Ames, 523; MacMillan, Metas. Minn. Val., 101; Tracy, Fl. Mo., 91; Bessey, Cont. Fl. Iowa, 123; Brendel, Fl. Peoriana, 61; Wheeler, Fl. Milwaukee Co., Wis., 186; Webber, Fl. Neb., 99; Rydberg, Fl. Black Hills, S. D., 527; Fink, Iowa Acad. Sci., IV, 105.

Everywhere very common in low ground, margins of streams and ponds, and in swamps. Very variable in size, from 1 foot or less in height, with spikes 2–6 lines in length, to 4 feet high, with spikes 8 lines long and 3 lines wide.

Ames, various collectors; Emmet county, *Cratty;* Hamilton county, 1891, *Rolfs;* Fayette county, 1894, *Fink;* Shelby county, *Fitzpatrick;* Grinnell, June, 1886, *Johnson*; Scott and Muscatine counties, *Barnes & Miller;* Decatur county, 1897, *Fitzpatrick;* Missouri Valley, June 21, 1897, *Pammel;* Gilbert, July 17, 1897, *Combs & Ball.*

4. E. PALUSTRIS GLAUCESCENS (*Willd.*) *Gray.* Man., 5th ed., 558 (1867).

Illus. Flora, 1, 252; Gray's Man., 6th ed., 575; Upham, Fl. Minn., 151; Rydberg, Fl. Sand Hills, Neb., 184.

Low, wet ground, eastern half of the state; perhaps often confounded with the type from which it is distinguished by its more slender culms, smaller akene, and narrower and more acute tubercle. Not before reported from Iowa.

Davenport, 1889, and Iowa City, *Hitchcock.*

5. E. ACICULARIS (*L.*) *R. & S.*

Scirpus acicularis L. Sp. Pl., 1, 48 (1753).

Illus. Flora, 1, 252, fig. 587; Gray's Man., 6th ed., 576; Arthur, Fl. Iowa, 33; Hitchcock, Pl. Ames, 523; MacMillan, Metas. Minn. Val., 100; Tracy; Fl. Mo., 91; Bessey, Cont. Fl. Iowa, 123; Brendel, Fl. Peoriana, 62; Bruhin, Fl. Wis., 278; Rydberg, Fl. Sand Hills, Neb., 184; Williams, Grass. and For. Pl. Daks., 41; Fink, Iowa Acad. Sci., IV, 105.

Very common throughout; edges of streams and ponds and low wet meadows; spikes more loosely flowered than our other species.

Charles City, Aug., 1875, *Arthur;* Iowa City, *Hitchcock;* Emmet and Dickinson counties, 1896, *Cratty;* Fayette county, 1893, *Fink;* Ames, 1883, *Hitchcock;* Poweshiek county, July, 1888, *Johnson;* Scott and Muscatine counties, *Barnes & Miller;* Kossuth county, 1897, *Cratty;* Missouri bottom near Bartlett, Sept. 20, 1897, *Baldwin;* Gilbert, July 17, 1887, No. 438, *Combs & Ball.*

6. E. wolfii (*A. Gray*) *Britton.* Jour. N. Y. Micros. Soc. v, 105 (1889.)

Scirpus wolfii Gray. Proc. Am. Acad., x, 77 (1874).

Illus. Flora, I. 252, fig. 588; Gray's Man., 6th ed., 576; Arthur, Cont. Fl. Iowa, vi; MacMillan, Metas. Minn. Val., 99; Brendel, Fl. Peoriana, 61.

Low ground on prairies, the culms much compressed, light colored and weak. A rare species, also occurring locally in Illinois and southern Minnesota.

Emmet county, 1886, *Cratty;* Iowa City, *Hitchcock.*

7. E. tenuis (*Willd.*) *Schultes.*

Scirpus tenuis Willd, Enum., 1, 76 (1809).

Illus. Flora, 1, 255, fig. 595; Gray's Man., 6th ed., 575; MacMillan, Metas. Minn. Val., 100; Tracy, Fl. Mo., 91; Brendel, Fl. Peoriana, 62; Wheeler, Fl. Milwaukee Co., Wis., 186.

Probably rare within our limits; not before reported from Iowa. Its perennial habit at once distinguishes the growing plant from *E. intermedia* (Muhl.) Schultes, with which the dried plant is apt to be confounded when not in mature fruit.

Iowa City, *Hitchcock;* Grinnell, May, 1886, *Norris;* Decatur county, May 24, 1897, probably this, the fruit not matured, *Fitzpatrick.*

8. E. acuminata (*Muhl.*) *Nees.* Linnæa, ix, 294 (1835).

E. compressa Sulliv. Sill. Jour., xlii, 50 (1842).

Illus. Flora, 1, 255, fig. 595; Gray's Man., 6th ed., 576; Arthur, Fl. Iowa, 33; MacMillan, Metas. Minn. Val., 101; Tracy, Fl. Mo., 91; Brendel, Fl. Peoriana, 61; Wheeler, Fl. Milwaukee Co., Wis., 186; Rydberg, Fl. Bl. Hills, S. D., 527.

Low ground, southern and eastern portions of the state. Probably not very common within our limits.

Iowa City, *Hitchcock;* Grinnell, June, 1894, *Johnson;* Scott and Muscatine counties, *Barnes & Miller;* Hancock county, 1881, *Ehinger;* Ames, July, 1875, *Arthur;* Peru, July, 1897, No. 395, *Hollingsworth.*

9. E. intermedia (*Muhl.*) *Schultes.* Mant., ii, 91 (1824).

Illus. Flora, 1, 255, fig. 597; Gray's Man., 6th ed., 575; Arthur, Fl. Iowa, 33; MacMillan, Metas. Minn. Val., 100; Tracy, Fl. Mo., 91; Brendel, Fl. Peoriana, 61; Bruhin, Fl. Wis., 278.

Low ground, probably rare within our limits. Distinguished from *E. tenuis* (Willd.) Schultes, which it somewhat resembles, by its annual, fibrous root, smoother akene with persistent bristles.

Story City, 1891, *Pammel;* Charles City, Aug., 1875, *Arthur*.

STENOPHYLLUS *Raf.* Neog. 4 (1825).

A genus of about 20 annual or perennial sedges, represented in the northern United States by a single species.

1. S. CAPILLARIS (*L.*) *Britton*. Bull. Torr. Club, XXI, 30 (1894).

Fimbristylis capillaris A. Gray. Man., 1st ed., 530 (1848).

Illus. Flora, I, 258, fig. 603; Gray's Man., 6th ed., 578; Arthur, Cont. Fl. Iowa IV; MacMillan, Metas. Minn. Val., 103; Tracy, Fl. Mo., 92; Brendel, Fl. Peoriana, 88; Hale, Add. Fl. Wis., 5; Webber, App. Fl. Neb., 24.

Rare in sand on banks of streams: eastern portion of the state. Readily distinguished from the next growing in similar situations by its very numerous and finely capillary culms.

Fruitland, Muscatine county, Aug., 1896, and Noels, Scott county, *Barnes & Miller;* bank of Mississippi River at Oquawka, Ills., *Patterson*.

FIMBRISTYLIS *Vahl.* Enum., II, 285 (1806).

A large genus with culms leafy below and bearing spikelets in small umbels or capitate heads. It differs from the preceding genus in having the swollen base of the style deciduous.

North America, 8 or 9 species.

Illus. Flora, 4; Gray's Man., 6th ed., 3; Tracy, Fl. Mo., 2; Webber, App. Fl. Neb., 1.

1. F. AUTUMNALIS (*L.*) *R. & S.* Syst., II, 97 (1817).

Scirpus autumnalis L. Mont., II, 180 (1781).

Illus. Flora, I, 260, fig. 608; Gray's Man. 578; Tracy, Fl. Mo., 92; Brendel, Fl. Peoriana, 62.

Rare in the eastern part of the state, sandy margins of streams and ponds; variable.

Keokuk, *Ehinger;* Oquawka, Ills., *Patterson;* Fruitland, Muscatine county, a form more slender than the type in wet soil. Also from Moscow, a lower, very densely tufted form with minutely papillose-hairy leaves, the spikelets oblong, about 3 lines long, the akene larger. *Barnes & Miller.*

NOTE.—*F. castanea* (Michx.) Vahl, Enum., II, 292 (1806), (*F. spadicea* var. *castanea* Torr.) was collected on the Mississippi bottoms near Oquawka, Ill., Aug., 1884, by Mr. H. N. Patterson, and probably occurs on the Iowa side of the river. It is also reported from Nebraska and Missouri.

SCIRPUS *L.* Sp. Pl., 47 (1753).

A large genus of annual or perennial sedges, our species varying in height from a few inches to eight or ten feet. Stems leafy in all the Iowa species except *S. lacustris* L. where they are reduced to basal sheaths.

Species about 200; 35 or 40 in the United States.

Illus. Flora, 28; Gray's Man., 6th ed., 17; Arthur, Fl. Iowa, 6; MacMillan, Metas. Minn. Val., 5; Tracy, Fl. Mo., 9; Brendel, Fl. Peoriana, 3; Webber, Fl. Neb., and Rep. I–IV, 9; Williams, Grass and For. Pl. Daks., 5; Fink, Fl. Fayette, Iowa, 2.

1. S. HALLII *A. Gray.* Man., 2nd ed., Add. (1863.)

S. supinus var. *hallii* A. Gray. Man., 5th ed., 563 (1867).

Illus. Flora, I, 264, fig. 615; Gray's Man., 6th ed, 580; Tracy, Fl. Mo., 92; Brendel, Fl. Peoriana, 88.

A low, tufted annual, growing in wet soil, and very rare within our limits. Not before reported from Iowa.

Muscatine county, *Reppert.* I am indebted to Mr. Wm. D. Barnes of Blue Grass for his single specimen for examination.

2. S. AMERICANUS *Pers.* Syn., I, 68 (1805).

S. triangularis (Pers.), MacMillan, Metas. Minn. Val., 99 (1892).

S. pungens Vahl. Enum., II, 255 (1806).

Illus. Flora, I, 255, fig. 618; Gray's Man., 6th ed., 579; Arthur, Cont. Fl. Iowa, VI; Hitchcock, Pl. Ames, 523; MacMillan, Metas. Minn. Val., 99; Tracy, Fl. Mo., 92; Brendel, Fl. Peoriana, 62; Bruhin, Fl. Wis., 278; Webber, Fl. Neb., 99; Rydberg, Fl. Bl. Hills, S. D., 526.

Rather rare in swamps and along the edges of ponds. Probably throughout the state.

Ames, 1885, and Davenport, 1889, *Hitchcock;* Walled Lake, 1889, *Bessey;* Powesheik county, June, 1885, *Johnson;* Scott and Muscatine counties, *Barnes & Miller;* Granite, Lyon county, June, 1897, *Shimek.*

3. S. LACUSTRIS *L.* Sp. Pl., I, 48 (1753).

S. validus Vahl. Enum., II, 268 (1806).

Illus. Flora, I, 266, fig. 623; Gray's Man., 6th ed., 580; Arthur, Fl. Iowa, 33; Hitchcock, Pl. Ames, 523; MacMillan, Metas. Minn. Val., 98; Tracy, Fl. Mo., 92; Bessey, Cont. Fl. Iowa, 123; Brendel, Fl. Peoriana, 62; Wheeler, Fl. Milwaukee Co., Wis., 186; Rydberg, Fl. Sand Hills, Neb., 184; Rydberg, Fl. Bl. Hills, S. D., 526; Fink, Iowa Acad. Sci., IV, 105.

Our most common species; shallow water, margins of streams and lakes. Varies greatly in the size of its spikes and panicle, the culm from ¼ to 1 inch in diameter at the base. The leaves of this species are reduced to basal sheaths.

Ames, 1884, *Hitchcock;* Emmet county, 1890, and Spirit Lake, 1896, *Cratty;* Monticello, 1876, *Bessey;* Lawler, 1876, *Rolfs;* Charles City, *Arthur;* Greene, 1891, *Miss Price;* Fayette county, 1894, *Fink;* Powesheik county, June, 1895, *Johnson;* Allamakee county, 1897, *Pammel;* Scott and Muscatine counties, *Barnes & Miller;* Kossuth county, July 21, 1897, *Pammel.*

4. S. FLUVIATILIS (*Torr.*) *Gray,* Man., 1st ed., 527 (1848).

S. maritimus var. *fluviatilis* Torr., Ann. Lyc. IV, N. Y., III, 324 (1836).

Illus. Flora, I, 268, fig. 628; Gray's Man., 6th ed., 581; Arthur, Cont. Fl. Iowa, III; Hitchcock, Pl. Ames, 523; MacMillan, Metas. Minn. Val., 98; Tracy, Fl. Mo., 92; Brendel, Fl. Peoriana, 88; Bruhin, Fl. Wis., 278; Rydberg, Fl. Sand Hills, Neb., 184; Williams, Grass. and For. Pl. Daks., 42.

Marshes, central, and northern portions of the state, less common than the preceding. A very coarse plant with numerous leaves, one-half inch or more in width, and large, triangular black akenes, 2 lines long.

Ames, 1885, and Carnsforth, *Hitchcock;* Emmet and Kossuth counties, *Cratty;* Ames, 1877, *Arthur;* Jasper county, 1886, *Johnson.*

5. S. ATROVIRENS *Muhl.* Gram., 43 (1817).

Illus. Flora, I, 269, fig. 630; Gray's Man., 6th ed., 581; Arthur, Fl. Iowa, 33; Hitchcock, Pl. Ames, 523; Mac Millan, Metas. Minn. Val., 97; Tracy, Fl. Mo., 92; Bessey, Cont. Fl. Iowa, 123; Fink, Iowa Acad. Sci., IV, 105; Brendel, Fl. Peoriana, 62; Wheeler, Fl. Milwaukee Co., Wis., 186; Webber, Fl. Neb., 99.

Throughout the state; very common in low ground or swamps. A broad-leaved species with very numerous small spikelets in dense capitate clusters. The var. *pallidus* Britton has been found in Minnesota and Nebraska and is to be sought in the northwestern part of the state.

Woodbine, 1874, *Burgess;* Ames, 1886, *Hitchcock;* Muscatine, *Reppert;* Fayette county, 1894, *Fink;* Shelby county, June, 1894, *Fitzpatrick;* Webster county, 1891, *Hitchcock*; Grinnell, July, 1895, *Johnson;* Emmet and Kossuth counties, 1897, *Cratty;* Scott and Muscatine counties, *Barnes & Miller*; Charles City, *Arthur;* Boone, July, 1897, *Steele;* Birmingham, Aug., 1897, No. 453, *Baldwin;* Kossuth county, Aug. 21, 1897, *Pammel;* Nevada, July 2, 1897, *Vernon;* Mount Pleasant, Oct. 1, 1897, *Dr. Mitte.*

6. S. LINEATUS *Mich.* Fl. Bor. Am., I, 32 (1803).

Eriophorum lineatum Benth. & Hook., Gen. Pl., III, 1,052 (1883).

Illus. Flora, I, 270, fig. 635; Gray's Man., 6th ed., 582; Arthur, Fl. Iowa, 33; Hitchcock, Pl. Ames, 523; MacMillan, Metas. Minn. Val., 96; Tracy, Fl. Mo., 92; Brendel, Fl. Peoriana, 62; Bruhin, Fl. Wis., 278.

Low ground, margins of streams and in swamps; not common. This and the following species are often referred to *Eriophorum* from which genus they differ principally in having the bristles to the akenes much shorter.

Ames, *Hitchcock;* Clinton, 1896, *Ball;* Story county, June, 1886, *Johnson;* Scott and Muscatine counties, *Barnes & Miller;* Decatur county, July 2, 1896, *Fitzpatrick;* Fort Dodge, July 5, 1897, *Shimek;* Peru, July 20, 1897, No. 394, *Hollingsworth;* Lebar, July 5, 1897, *Sample.*

7. S. CYPERINUS (*L.*) *Kunth.* Enum., II, 170 (1837).

Eriophorum cyperinum L. Sp. Pl. 2nd ed., 77 (1762).

Illus. Flora, I, 271, fig. 636; Gray's Man., 6th ed., 582; Arthur, Fl. Iowa, 33; Hitchcock, Pl. Ames, 524; MacMillan, Metas. Minn. Val., 96; Brendel, Fl. Peoriana, 88; Wheeler, Fl. Milwaukee Co., Wis., 186; Rydberg, Fl. Bl. Hills, S. D., 527; Fink, Iowa Acad. Sci., IV, 105.

Habitat and range similar to the preceding from which it differs in having the spikelets in capitate clusters, and the bristles to the mature fruit much longer. A variable plant.

Iowa City, *Hitchcock;* Fayette county, 1894, *Fink;* Jasper county, Aug., 1885, *Johnson;* Scott and Muscatine counties, *Barnes & Miller;* Charles City, *Arthur.*

ERIOPHORUM *L.* Sp. Pl. 52 (1753).

A small genus of perennial bog sedges restricted to the northern hemisphere. The perfect flowers are disposed in solitary, capitate or umbelled spikes, and are furnished with a perianth of few or numerous bristles which are much elongated in fruit and very conspicuous, whence the popular name, Cotton-Grass.

Species about 10.

Illus. Flora, 7; Gray's Man., 6th ed., 5; Arthur, Fl. Iowa, 2; MacMillan, Metas. Minn. Val., 5; Tracy, Fl. Mo., 1; Brendel, Fl. Peoriana, 2; Webber, Fl. Neb., and Rep. I–IV, 2.

1. E. POLYSTACHYON *L.* Sp. Pl. 52 (1753).

Illus. Flora, I, 273, fig. 641; Gray's Man., 6th ed., 583; Arthur, Cont. Fl. Iowa, III; Hitchcock, Pl. Ames, 524; MacMillan, Metas. Minn. Val., 95; Bessey, Cont. Fl. Iowa, 123; Brendel, Fl. Peoriana, 88; Wheeler, Fl. Milwaukee Co., Wis., 186; Fink, Iowa Acad. Sci., IV, 105.

Swamps, throughout the northern and eastern portions of the state. Quite variable in regard to width of leaves, size of spikes, and length of bristles. The latter are usually a bright white, but forms were collected by the author in Emmet county with the bristles slightly russet-tinged, and a similar form was collected by Prof. B. Fink in Fayette county. The color, though similar, is much lighter than that of *E. russeolum* Fries.

Ames, June, 1870, *Arthur;* Emmet and Kossuth counties, numerous collections, *Cratty;* Fremont county, 1894, *Fink;* Rock Creek tp., Jasper county, April 10 and May 29, 1896, *Johnson;* Eldridge, Scott county, *Barnes & Miller.*

2. E. GRACILE *Koch.* Cat. II, 259 (1800).

E. gracile var. *paucinervium* Eng., Gray's Man., 2nd ed., 502 (1852).

Illus. Flora, I, 273, fig. 642; Gray's Man., 6th ed., 583; Arthur, Cont. Fl. Iowa, V; MacMillan, Metas. Minn. Val., 94; Tracy, Fl. Mo., 92; Brendel, Fl. Peoriana, 62; Hale, Add. Fl. Wis., 5; Rydberg, Fl. Sand Hills, Neb., 184.

A slender bog species with spikes one-half the size of those of the preceding species, the bristles shorter. Our plant is what was formerly called the var. *paucinervium* Eng. The plant is also common in northern Europe.

Emmet county, May, 1883, *Cratty;* Clarion, Wright county, May, 1886, *Rev. E. P. Childs.*

HEMICARPHA *Nees. & Arn.* Ed. New. Phil. Jour., XVII, 263 (1834).

Low, tufted sedges, closely related to *Scirpus.* About 3 species, of which 2 occur in the United States, the other in the tropics.

1. H. MICRANTHA (*Vahl.*) *Britton.* Bull. Torr. Club., XV, 104 (1888).

H. subsquarrosa Nees., in Mart., II, pt. I, 61 (1843).

Illus. Flora, I, 275, fig. 646; Gray's Man., 6th ed., 583; Arthur, Cont. Fl. Iowa, III; Hitchcock, Pl. Ames, 524; MacMillan, Metas. Minn. Val., 90; Tracy, Fl. Mo., 91; Brendel, Fl. Peoriana, 61; Hale, Add. Fl. Wis., 5.

Wet, sandy soil; known only from the central and eastern portions of the state. A small, inconspicuous plant, easily overlooked by any but a careful observer. Sometimes confounded with *Cyperus inflexus* Muhl.

Iowa City, 1887, Waterloo, 1889, and Story county, *Hitchcock;* Scott and Muscatine counties, *Barnes & Miller.*

NOTES.—1. *Rhynchospora alba* (L.) Vahl. and *R. capillacea* Torr. will probably yet be found in Iowa. The former species is reported from Minnesota, Illinois, and Kansas: the latter from Minnesota, Illinois, Kansas, and South Dakota.

2. *Cladium mariscoides* (Muhl) Torr. Ann. Lyc. N. Y., II, 372 (1836), is credited to Iowa in Gray's Manual, 6th ed., 586, and in the Illustrated Flora, I, 281. I have been unable to find an Iowa specimen of this plant in any collection in the state, nor can one be found in herbaria of the State University of Minnesota, the Missouri Botanical Gardens, the Gray herbarium, nor the herbarium of the Columbia University, New York City. Dr. Britton writes me that he took the Iowa range of the plant from Gray's Manual. It is very doubtful whether the plant has been detected within our limits, but subsequent research may yet bring it to light. Mr. A. A. Heller writes me from Minneapolis that they have Minnesota specimens in the State University herbarium. It is also reported from Wisconsin by Bruhin, and from Illinois by Brendel.

SCLERIA *Berg.* Kongl. Acad. Sv. Handl., XXVI, 142 (1765).

A large genus of some 100 species, of which number 10 occur in the eastern United States. Annuals or perennials.

Illus. Flora, 6; Gray's Man., 6th ed., 63; Arthur, Fl. Iowa, 1: MacMillan, Metas. Minn. Val., 2; Tracy, Fl. Mo., 1.

1. S. TRIGLOMERATA *Michx.* Fl. N. A., II, 168 (1803).

Illus. Flora, I, 282, fig. 663; Gray's Man., 6th ed., 586: Arthur, Fl. Iowa, 33; MacMillan, Metas, Minn. Val., 105; Tracy, Fl. Mo., 92: Brendel, Fl. Peoriana, 62: Bruhin, Fl. Wis., 278.

Rare in the central, eastern, and southern portions of the state: low ground and thickets. The conical, bright white akenes are exposed in the mature plant.

Charles City and Elmira, 1889, *Hitchcock:* Grinnell, June, 1886, *Johnson;* Wild Cat Den, Muscatine county, *Barnes & Miller;* Charles City, 1881, *Arthur;* Decatur county, in flower, June 8, and in fruit July 2, 1897, *Fitzpatrick.*

NOTE—*Scleria verticillata* Muhl. has been reported from Minnesota, Illinois, and Kansas, and Prof. L. H. Pammel tells me he has collected it near La Crosse, Wisconsin. It probably occurs in the eastern part of our state.

CAREX *L.* Sp. Pl., 972 (1753).

A vast and difficult genus which contains about two-thirds of all our sedges. The unisexual, monœcious or diœcious flowers present little variation, hence the specific characters are mostly founded on the scales, mature fruit, and the character and disposition of the spikes, and even here the diversity is so small when compared with the number of species as to render the genus an exceedingly difficult one for the student. In height our species are from a few inches to about four feet. Most of these plants grow somewhat scattered, interspersed with the grasses; some are extensively stoloniferous, forming patches, while others grow in large and dense tufts. The greater number prefer damp situations, growing in marshes and swales, or along the margins of ponds and streams. Some occur only in timber, while a few delight in a very dry soil and assist in forming a scant covering for sterile knolls and hillsides.

Dr. C. E. Bessey in the report of the Iowa Agricultural College for 1871 published the first Contribution to the Flora of Iowa, in which is given a short list of the sedges then known to the state. In the Flora of Iowa, a catalogue of the flowering plants prepared by Dr. J. C. Arthur for the Centennial Commission, is given a more complete list of these plants. To this latter publication Dr. Arthur made several additions, and Prof. A. S. Hitchcock, formerly of Ames, gave some additional species in a paper published in the Bulletin of the Torrey Botanical Club, and in his catalogue of the Plants of Ames. The number of species and varieties of the genus *Carex* noted in these publications is as follows:

Arthur, Cont. Fl. Iowa,	I (1876),	39
“ “ “ “	II (1877),	1
“ “ “ “	III (1878),	10
“ “ “ “	IV (1880),	5
“ “ “ “	V (1882),	10
“ “ “ “	VI (1883).	1
Hitchcock, Bull. Torr. Club, XVI, 89,	(1889),	1
Hitchcock, Plants of Ames, *additional*,	(1891),	5
Total,		72

This number should be somewhat reduced as several of the varieties included in the above estimate are no longer recognized.

The following species of the Iowa flora are also natives of Europe, and it is a noticeable fact that they are mostly high northern forms:

Carex stenophylla Wahl.
Carex chordorrhiza Linn. f.
Carex filiformis L.
Carex riparia W. Curtis.
Carex fusca All
Carex limosa L.
Carex teretiuscula Good.

The genus contains over 1,000 species, of which number North America, north of Mexico, contains over 300.

Illus. Flora, 205; Gray's Man., 6th ed., 133. Species and varieties catalogued in Arthur, Cont. Fl. Iowa, I–VI, 66; MacMillan, Metas. Minn. Val., 60; Tracy, Fl. Mo., 72; Bessey, Cont. Fl. Iowa, 15; Brendel, Fl. Peoriana (including the state), 76; Smythe, Pl. Kansas, 67; Upham, Fl. Minn., 89; Bruhin, Ver. Fl. Wis., 69; Webber, Fl. Neb. and Rep. I–IV, 45; Rydberg, Fl. Bl. Hills, S. D., 19; Williams, Grass. and For. Pl. Daks., 19; Fink, Fl. Fayette, Iowa, 19.

1. C. INTUMESCENS *Rudge*. Linn. Trans., VII, 97 (1804).

Illus. Flora, I, 293, fig. 675; Gray's Man., 6th ed., 592; Arthur, Fl. Iowa, 34; Hitchcock, Pl. Ames, 524; MacMillan, Metas. Minn. Val., 129; Tracy, Fl. Mo., 93; Wheeler, Fl. Milwaukee Co., Wis., 187.

Rare in low ground. This probably includes all of the Iowa plants heretofore referred to *C. folliculata* L. This latter species is yellowish colored, especially the fertile spikes, the perigynia less inflated, and probably does not range farther west than Michigan. *C. intumescens* Rudge is green throughout, the perigynia much inflated.

Ames, *Arthur;* Story county, *Hitchcock;* Shelby county, July, 1895, *Fitzpatrick.*

2. C. ASA–GRAYI *Bailey*. Bull. Torr. Club, XX, 427 (1893).

C. grayi Carey, Sil!. Jour., 2nd ser., IV, 22 (1847), not *C. grayana* Dew. (1834).

Illus. Flora, I, 293, fig. 576; Gray's Man., 6th ed., 592; Arthur, Cont. Fl. Iowa, III; Hitchcock, Pl. Ames, 524; Brendel, Fl. Peoriana, 63; Bruhin, Zwei. Nach. Fl. Wis., 643.

A very striking plant, well distributed throughout the southern and eastern portions of the state. The perigynia crowded in globose heads, otherwise much resembling *C. intumescens* Rudge.

Johnson county, 1894, and Keokuk, 1895, *Shimek;* Ames, *Hitchcock;* Richland tp., Jasper county, July 4, 1884, the hispid form, *Norris*, and 1886, *Johnson;* Clinton, Scott, and Muscatine counties, frequent, *Barnes & Miller;* Appanoose county, July 4, 1889, *Fitzpatrick.*

3. C. LUPULINA *Muhl.* Schk. Riedg., II. 54 (1806).

Illus. Flora, I, 294, fig. 678; Gray's Man., 6th ed , 593: Arthur, Fl. Iowa, 34; Hitchcock, Pl. Ames, 524; MacMillan, Metas. Minn. Val., 129; Tracy, Fl. Mo., 93; Brendel, Fl. Peoriana, 63; Wheeler, Fl. Milwaukee Co., Wis., 187; Bot. Surv. Neb., IV., 45; Fink, Iowa Acad. Sci., IV, 105.

Margins of swamps; throughout, but not plentiful. The more common form has the spikes peduncled (var. *pedunculata* Dew.). *C. lupuliformis* Sartwell, is reported from Minnesota and possibly occurs within our limits.

Emmet county, south shore of Iowa Lake, 1896, *Cratty*,· Johnson county, 1894, *Shimek*, and Iowa City, 1887, *Hitchcock;* Fayette county, 1894, *Fink*,· Mississippi bottoms, La Crosse, Wis., 1887, *Pammel;* Ames, 1886, *Hitchcock;* Jasper county, July 4, 1884, and May, 1886, *Johnson:* Clinton, Scott and Muscatine counties, *Barnes & Miller:* Charles City, Aug., 1875, *Arthur;* Johnson county, July, 1897, *Misses Finch & Cavanagh;* Keokuk, June 1, 1897, *Shimek;* Ames, July 1894, *Stewart.*

4. C. MONILE *Tuck.* Enum. Meth. 20 (1843).

Illus. Flora. I, 297, fig. 688; Gray's Man. 6th ed., 594; Arthur, Cont. Fl. Iowa, v; MacMillan, Metas. Minn. Val., 128; Tracy, Fl. Mo., 94; Brendel, Fl. Peoriana, 63; Wheeler, Fl. Milwaukee Co., Wis., 187.

Very low ground, growing in dense tufts; the whole plant light colored, especially the fertile spikes.

Emmet county, 1887, *Cratty;* Iowa City, a form much resembling *C. utriculata* Boott, *Hitchcock;* Richland tp., Jasper county, May 29, 1886, *Norris;* Moscow, Muscatine county and Noels, Scott county, *Barnes & Miller.*

5. C. TUCKERMANI *Dew.* Am. Jour. Sci., XLIX, 48 (1845).

Illus. Flora, I, 298, fig. 689; Gray's Man., 6th ed., 594; Tracy, Fl. Mo., 95; Brendel, Fl. Peoriana, 88; Upham, Supl. Fl. Minn., 49; Bruhin, Fl., Wis., 280.

Low swampy ground. rare: not before reported from Iowa. Grinnell, collected about 1887. by Prof. H. W. Norris. and now in the herbarium of the Iowa Agricultural College. Its southern range recorded in our text books is New Jersey, Michigan. and Minnesota. The author has a specimen in his herbarium collected in Illinois many years ago by Dr. S. B. Mead, and it is reported from Missouri by Prof. Tracy.

6. C. RETRORSA *Schwein.* Ann. Lyc. N. Y., I, 70 (1824).

Illus. Flora, I, 298, fig. 691; Gray's Man., 6th ed., 595; Arthur, Cont. Fl Iowa, V; MacMillan, Metas. Minn. Val., 127; Brendel, Fl. Peoriana, 88; Hale, Add. Fl. Wis., 5; Rydberg, Fl. Bl. Hills, S. D., 528; Fink, Iowa Acad. Sci., IV, 105.

Low ground in woods and along the margins of streams and sloughs: northern half of the state. rare. This is sometimes found growing with *C. lupulina* Muhl. between which hybrids have been found in New York and Michigan and probably occur within our limits.

Estherville, 1881, and Iowa Lake, 1896, *Cratty;* Fayette county, 1895, *Miss Ona M. Rounds.*

7. C. LURIDA PARVULA (*Paine*) *Bailey.* Bull. Torr. Club, XX, 418 (1893).

C. tentaculata var. *parvula* Paine, Cat. Oneida Pl., 105 (1865).

Illus. Flora, I, 297; Hitchcock, Pl. Ames, 524.

Sloughs. very rare. Ames. 1886. *Hitchcock.* This is the *C. lurida* of Hitchcock's Plants of Ames. 524. a specimen of which is now in the Iowa Agricultural College herbarium.

"Low—(8–16 in. high), very slender, with one or two spikes which are half or less the size of those in the type, sessile, or very nearly so; perygina not more than half the size of those in the common form." *Prof. L. H. Bailey in Bull. Torr. Club.* l. c.

8. C. HYSTRICINA *Muhl.* Willd. Sp. Pl., IV, 282 (1805).

Illus. Flora, I, 300, fig. 696; Gray's Man., 6th ed., 596; Arthur, Fl. Iowa, 34; MacMillan, Metas. Minn. Val., 127; Tracy, Fl. Mo., 93; Higley & Raddin, Fl. Cook Co., Ills., 131; Bessey, Cont. Fl. Iowa, 124; Bruhin, Fl. Wis., 280; Rydberg, Fl. Sand Hills, Neb., 184; Webber, Fl. Neb., 98.

Margins of streams and ponds; rather common throughout. *C. pseudo-cyperus* L. has been reported from this state, but specimens which I have seen so labelled I consider forms of the above.

Charles City, June, 1875, *Arthur;* Estherville, 1882, and Spirit Lake, July 29, 1896, *Cratty;* Johnson county, 1887, *Hitchcock*, and 1894, *Shimek;* Spirit Lake, July 24, 1883, *Arthur;* Grinnell, June, 1885, *Norris*, and 1886, *Johnson;* Scott and Muscatine counties, *Barnes & Miller;* Granite, June, 1897, *Shimek.*

9. C. COMOSA *Boott.* Linn. Trans., XX, 117 (1846).

C. pseudo-cyperus var. *comosa* Boott, Bot. Cal. II, 252 (1880).
C. pseudo-cyperus var. *americana* Hochst., Herb. Unio. Itin. (1837).

Illus. Flora, I, 301, fig. 698; Gray's Man., 6th ed., 596; Arthur, Cont. Fl. Iowa, V; MacMillan, Metas. Minn. Val., 126; Brendel, Fl. Peoriana, 63; Bruhin, Fl. Wis., 280; Bot. Surv. Neb., III, 16.

Central and northern portions of the state; sloughs and margins of ponds. The large, nodding, comose spikes render this a very conspicuous plant.

Emmet county, 1891, *Cratty;* Cedar Rapids, *Hitchcock;* borders of lagoons along Cedar River, Muscatine county, *Barnes & Miller.*

10. C. SQUARROSA *L.* Sp. Pl., II, 973 (1753).

Illus. Flora, 301, fig. 700; Gray's Man., 6th ed., 596; Arthur, Cont. Fl. Iowa, III; MacMillan, Metas. Minn. Val., 126; Tracy, Fl. Mo., 94; Brendel, Fl. Peoriana, 63; Bruhin, Zwei. Nach. Fl. Wis., 643; Webber, App. Fl. Neb., 23.

Rare in swamps; differs from the following species, which has generally been considered a synonym, in its lighter green color, narrower leaves, rarely more than 2 lines wide, and linear-oblong akene. Widely distributed throughout the Misssissippi valley.

Appanoose county, July, 1896, *Fitzpatrick;* near Skunk River, Jasper county, July 3, 1886, *Norris.*

11. C. TYPHINOIDES *Schwein.* Ann. Lyc., I, 66 (1824).

C. squarrosa Gray's Man., 6th ed., 596 (1890), in part.

C. squarrosa var. *typhinoides* Dewey, Am. Jour. Sci., XI, 316 (1826).

Illus. Flora I, 302, fig. 701.

This species, not before reported from Iowa, closely resembles *C. squarrosa* L. from which it is distinguished by its darker green leaves, 4 to 5 lines wide, and the broader akene which is 3 angled, ovoid-elliptic, with concave sides It occurs in swamps in the eastern part of the state, and includes many of the Iowa forms heretofore referred to the preceding species.

Fredericksburg, Chickasaw county, *Miss Howe;* banks of the Wapsipinicon, Scott county, July, 1896, and Clinton and Muscatine counties, usually growing with *C. asa-grayi* Bailey, *Barnes & Miller;* Mississippi bottoms, Oquawka, Illinois, *Patterson.*

12. C. TRICHOCARPA *Muhl.* Willd. Sp. Pl., IV, 302 (1805)

C. trichocarpa var. *imberbis* Gray's, Man., 5th ed., 597 (1867).

C. trichocarpa var. *deweyi* Bailey, Bot. Gaz., X, (1883),

C. trichocarpa var. *læviconica* (Dew.) Hitchcock. Trans. St. Louis Acad. Sci., 524 (1891).

Illus. Flora, I, 302, fig. 702; Gray's Man., 6th ed., 598; Arthur, Cont. Fl. Iowa, IV; Hitchcock, Pl. Ames, 524; MacMillan, Metas. Minn.Val., 124; Tracy, Fl. Mo., 94; Brendel, Fl. Peoriana, 63; Webber, Pl. Neb., 98.

Sloughs and margins of ponds and streams; common and very variable. We have besides the type the forms previously called var. *imberbis* and var. *deweyi*, of which the latter at least, seems worthy of varietal recognition.

Estherville, Emmet county, June 18, 1882, the pubescent form, *Cratty;* Iowa City, *Hitchcock;* Johnson county, 1894, *Shimek;* Ames, 1880, *Bessey*, and 1886, *Hitchcock;* West Davenport, 1895, and Muscatine county, the glabrous form, *Barnes & Miller;* Shelby county, 1894, a form with pubescent perigynia, but the long, wide-spreading teeth like those of the next species, *Fitzpatrick;* Poweshiek county, 1885, *Norris*, and 1886, *Johnson;* Granite, Lyon county, June, 1897, a form approaching the next species, and Keokuk, June 1, 1897, a very slender form with smooth peryginia, *Shimek;* Ames, May 22, 1877, *Arthur*.

13. C. ARISTATA *R. Br.* Rich. Bot. App., 751 (1823).

C. trichocarpa var. *aristata* Bailey, Bot. Gaz., x, 293 (1885).

Illus. Flora, I, 302, fig. 703; Gray's Man., 6th ed., 598; Hitchcock, Pl. Ames' 524, and Bull. Torr. Club., XVI, 70; MacMillan, Metas. Minn. Val., 124; Tracy, Fl. Mo., 92; Bruhin, Fl. Wis., 280; Williams, Grass. & For. Pl. Daks., 42.

Margins of ponds and streams; probably throughout the state but not common. This and the preceding species seem to run together.

Emmet county, 1878, *Cratty;* Story county, *Hitchcock;* Hamilton county, 1884, *Rolfs:* Johnson county, 1894, *Fitzpatrick:* High Bridge, Dallas county, July 6, 1897, and Keokuk, June 1, 1897, *Shimek.* The latter approaches the preceding species.

14. C. RIPARIA *W. Curtis.* Fl. Lond., IV, Pl., 60 (1821).

Illus. Flora, I, 303, fig. 704; Gray's Man., 6th ed., 598; Arthur, Cont. Fl. Iowa, IV; Hitchcock, Pl. Ames, 524: MacMillan, Metas. Minn. Val., 124; Tracy, Fl. Mo., 94; Brendel, Fl. Peoriana, 63; Bruhin, Fl. Wis, 280.

Sloughs, probably throughout the state, but not very plentiful. The perigynia dark colored and polished at maturity. So far as I have observed this species it rarely flowers or fruits.

Grinnell, 1877, *Jones;* Emmet county, 1878, *Cratty;* Richland tp., Jasper county, May, 1886, *Johnson;* Story City, June 7, 1897, No. 422, *Pammel & Beyer*.

15. C. SHORTIANA *Dew.* Am. Jour, Sci., XXX, 60 (1836). Pl. II.

Illus. Flora, I, 303, fig. 706; Gray's Man., 6th ed., 596; Tracy, Fl. Mo., 94; Brendel, Fl. Peoriana, 62; Webber, Fl. Neb., 98.

Rare in moist woods and thickets, eastern part of the state. Not before reported from Iowa. A very distinct species.

Ravines at Wild Cat Den, Muscatine county. June, 1895. *Barnes & Miller:* Keokuk, June 1, 1897, *Shimek.*

NOTE.—In Upham's Flora of Minnesota, p. 158, *Carex houghtoni* Torr Cyp., 413 (1836) is credited to this state.—"Council Bluffs, Iowa, Geyer." Search has been made in the herbaria of the University of Minnesota and of the Missouri Botanical Gardens for an Iowa specimen, but without success. I have been unable to find Prof. Upham's authority for the statement. This species is reported from Minnesota, Wisconsin, Kansas, and Nebraska.

16. C. LANUGINOSA *Michx.* Fl. N. A., II, 175 (1803).

C. *filiformis* var. *latifolia* Boeckl. Linn., XLI, 309 (1875).

C. *filiformis* var. *lanuginosa* B. S. P. Prelim. Cat. N. Y., 63 (1888).

Illus. Flora, I, 305, fig. 711; Gray's Man., 6th, ed. 597; Arthur, Fl. Iowa, 34; Hitchcock, Pl. Ames, 524; MacMillan, Metas. Minn. Val., 125; Bessey, Cont. Fl Iowa, 124; Brendel, Fl. Peoriana 63; Rydberg, Fl. Sand Hills, Neb., 185; Williams, Grass. & For. Pl. Daks. 42.

Low ground around marshes: throughout the state. The spikes are usually longer than those of *C. filiformis* L. which it much resembles.

Emmet county, 1878, *Cratty;* Ames, 1886, and Hancock county, *Hitchcock:* Shelby county, May, 1894, *Fitzpatrick:* Grinnell, 1885, *Norris:* Scott and Muscatine counties, *Barnes & Miller:* Missouri Valley, June 21, 1897, a very tall, loosely flowered form with spikes 1½ inches long, *Pammel.*

17. C. FILIFORMIS *L.* Sp. Pl., II. 976 (1753).

Illus. Flora, I, 305, fig. 712; Gray's Man., 6th ed., 597; Hitchcock, Pl. Ames, 524; MacMillan, Metas. Minn. Val., 125; Tracy, Fl. Mo., 93; Brendel, Fl. Peoriana, 63; Hale, Add. Fl. Wis., 5; Webber, Fl. Neb. 98.

Rare in bogs. This and a few other sedges, grasses, and aquatic mosses form by their long, interlacing roots the tough sod which covers the surface of the quaking bogs in the northwestern portion of the state. This sedge flowers and fruits here only under the most favorable conditions of moisture and temperature. Also a native of northern Europe.

Emmet county, 1878, *Cratty;* Ames, *Hitchcock;* Grinnell, 1885, *Norris.*

18. C. FUSCA *All.* Fl. Ped. II, 269 (1785).

C. buxbaumii Wahl. K. Acad. Handl. XXIV. 163 (1803).

Illus. Flora, I, 307, fig. 718; Gray's Man., 6th ed., 599; Arthur, Fl. Iowa, 34; MacMillan, Metas. Minn. Val., 123; Brendel, Fl. Peoriana, 62.

Not rare in low ground around sloughs; a beautiful species, the purple scales being very conspicuous. It also is a native of northern and central Europe.

Emmet county, 1878, *Cratty;* Ames, *Hitchcock;* Charles City, *Arthur;* Grinnell, May, 1886, *Norris;* Noels and Eldridge, Scott county, 1895, *Barnes & Miller;* High Bridge, Dallas county, July 6, 1897, a slender form 2 feet high, *Shimek;* Story City, June 7, 1897, No. 421, *Pammel & Beyers.*

19. C. STRICTA *Lam.* Encyc. Meth., III, 387 (1789).

Illus. Flora, I, 308, fig. 719; Gray's Man., 6th ed., 599; Arthur, Fl. Iowa, 34; Hitchcock, Pl. Ames, 524; MacMillan, Metas. Minn. Val., 123; Tracy, Fl. Mo., 95; Bessey, Cont. Fl. Iowa, 123; Brendel, Fl. Peoriana, 62; Wheeler, Fl. Milwaukee Co., Wis., 187; Rydberg, Fl. Black Hills, S. D., 527; Fink, Iowa Acad. Sci., IV, 105.

Sloughs and margins of ponds and streams throughout; common and very variable.

Fayette county, 1895, *Fink;* Johnson county, 1893, and Cedar Rapids, 1895, *Shimek;* Ames, *Hitchcock;* Emmet county, *Cratty;* Charles City, *Arthur;* Iowa City, *Hitchcock;* Grinnell, 1886, *Norris;* Decatur county, May, 1897, probably this, the plant in flower only, *Fitzpatrick;* Spirit Lake, June, 25, 1881, *Arthur;* Marshalltown, May, 1897, *Ball.*

20. C. STRICTA ANGUSTATA *Bailey* in Gray's Man., 6th ed., 600 (1890).

C. augustata Boott, in part. Hook. Fl. Bor. Am. II, 218 (1840),
Illus. Flora, I, 208; Bailey in Gray's Man., l. c.; Smythe, Pl. Kansas, 23; Williams, Grass. & For. Pl. Daks., 43.

Swales, central and eastern portions of the state; distinguished by its stricter habit, longer and more slender spikes, and narrow scales.

Eldridge, Scott county, June, 1895, frequent, *Barnes & Miller;* Johnson county, May, 1895, *Shimek.*

21. C. HAYDENI *Dew.* Am. Jour., 2nd ser., XVIII, 103 (1854).

C. aperta Carey in Gray's Man., 1st ed., 547 (1848), not Boott (1840).
C. stricta var. *decora* Bailey, Bot. Gaz., XIII, 85 (1888).
Illus. Flora, I, 308, fig. 970; Gray's Man., 6th ed., 600; Arthur, Fl. Iowa, 34; Tracy, Fl. Mo., 92; Brendel, Fl. Peoriana, 88; Hale, Add. Fl. Wis., 5; Williams, Grass. & For. Pl. Daks., 43.

Margins of ponds and streams; well distributed, but most common in the eastern half of the state. This and the two preceding are very variable in regard to height of plant, length of spikes, and comparative length of scales and perigynia.

Emmet county, 1878, *Cratty;* Fayette county, 1895, *Fink;* Johnson county, 1895, *Shimek;* Charles City, *Arthur;* Iowa City, *Hitchcock;* Grinnell, 1885, *Norris;* Scott and Muscatine counties, *Barnes & Miller*.

NOTE.—*Carex aquatilis* Wahl. has been reported from Iowa, (Fink, Proc. Iowa Acad. Sci., IV, 105) but there is considerable doubt regarding the identification, as the plants, specimens of which are in my herbarium, are in the early flowering state. It is more likely a form of *C. stricta* Lam. Mature fruiting specimens of the plant are very much desired.

22. C. LIMOSA *L.* Sp. Pl., II, 977 (1753).

Illus. Flora, I, 313, fig. 734; Bailey in Gray's Man., 6th ed., 602; Arthur, Cont. Fl. Iowa, V; MacMillan, Metas. Minn. Val., 121; Brendel, Fl. Peoriana, 62; Hale, Add. Fl. Wis., 5; Bot. Surv. Neb., III, 15.

Very rare in bogs; the nodding spikes on filiform peduncles give this sedge a very graceful appearance. Also a native of northern Europe.

Emmet county, in a large marsh on the n. e. ¼, sec. 13, Armstrong Grove tp., June, 1878, *Cratty*.

23. C. DAVISII *Schwein. & Torr.* Mon. Car., 326 (1825).

Illus. Flora, I, 318, fig. 751; Gray's Man., 6th ed., 605; Arthur, Fl. Iowa, 34; Hitchcock, Pl. Ames, 525; MacMillan, Metas. Minn. Val., 120; Tracy, Fl. Mo., 92; Brendel, Fl. Peoriana, 62; Hale, Add. Fl. Wis., 5.

Quite common in woods in the central and eastern portions. Several specimens of this plant have been seen in Iowa collections labelled *C. miliacea* Muhl. (now *C. prasina* Wahl.). This latter species may, however, yet be found within our limits, having been reported from Ramsey county, Minnesota (*Kossube*).

Johnson county, 1894, *Shimek*, and 1895, *Fitzpatrick;* Ames and Iowa City, *Hitchcock;* Jasper county, 1886, *Norris;* Noels, Scott county, and Moscow and West Liberty, Muscatine county, *Barnes & Miller;* Keokuk, June 1, 1897, *Shimek*.

24. C LONGIROSTRIS *Torr.* Schwein. Ann. Lyc. N. Y., I, 71 (1824).

Illus. Flora, I, 319, fig. 752; Bailey in Gray's Man., 6th ed., 603; Arthur, Fl. Iowa, 34; MacMillan, Metas. Minn. Val., 121; Bessey, Cont. Fl. Iowa, 124; Brendel. Fl. Peoriana, 63; Bruhin, Fl. Wis., 280; Webber, Fl. Neb., 98; Rydberg, Fl. Bl. Hills, S. D., 528.

Common in woods; a very distinct and graceful species.

Charles City, June, 1875, *Arthur;* Clinton county, 1878, *Butler;* Emmet county, various collections, *Cratty;* Fayette county, 1895, *Fink;* Ames, *Hitchcock;* Jasper county, May, 1886, *Norris;* Big Rock, Scott county, *Barnes & Miller.*

25. C. GRISEA *Wahl.* K. Acad. Handl,, XXIV, 154 (1803).

Illus. Flora I, 321, fig. 759; Gray's Man., 6th ed., 605; Arthur, Fl, Iowa, 34; Hitchcock, Pl. Ames, 525; MacMillan, Metas. Minn. Val., 120; Tracy, Fl. Mo., 93; Bessey, Cont. Fl. Iowa, 124; Brendel, Fl. Peoriana. 62; Webber, Fl. Neb., 98.

Rich woods, probably throughout the state.

Ames and Iowa City, *Hitchcock;* Charles City, 1885, *Arthur;* Lynnville, Jasper county, May, 1886, *Norris;* bank of Wapsipinicon, Scott county, 1895, *Barnes & Miller.*

26. C. AMPHIBOLA *Steud.* Syn. Pl. Cyp., 234 (1855). Pl. III.

C. grisea var. *angustifolia* Boott, Ill., 34 (1858).

Illus. Flora, I, 321, fig. 760; Bailey in Gray's Man., 6th ed., 605.

Northern and eastern portions of the state; rather rare in moist soil, especially in woods along streams. Leaves 1 to 2 lines wide, being much narrower than those of the preceding species which it much resembles. Not before reported from Iowa.

Emmet county, rare, 1880, *Cratty;* Scott county, 1895, frequent, *Barnes & Miller.*

27. C. GRANULARIS *Muhl.* Willd. Sp. Pl., IV, 279 (1805).

Illus. Flora, I, 322, fig. 763; Gray's Man., 6th ed., 605; Arthur, Cont. Fl. Iowa, IV; MacMillan, Metas. Minn. Val., 120; Tracy, Fl. Mo., 93; Brendel, Fl. Peoriana, 62; Wheeler, Fl. Milwaukee Co., Wis. 187; Bot. Surv. Neb., IV, 45.

Central and southeastern; not common.

Clinton county, 1878, *Butler;* Johnson county, 1894, *Shimek.* The staminate spike of the latter specimen prominently stalked, leaves 2-4 lines wide, the lower, fertile spike, distant.

28. C. CRAWII *Dewey.* Am. Jour. Sci., 2nd ser., II, 246 (1846). Pl. iv.

Illus. Flora, I, 323, fig. 764; Bailey in Gray's Man., 6th ed., 606; MacMillan, Metas. Minn. Val., 119; Hale, Add. Fl. Wis., 5; Rydberg & Shear, Bull. No. 5, U. S. Dept. Agricul., 41; Higley & Raddin, Fl. Cook Co., Ills. 133.

Prairies, rare; preferring rather moist ground. The whole plant, light colored, especially the wide leaves of the sterile shoots which are produced very freely from the stolons. Not before reported from Iowa.

Emmet county, 1½ miles northeast of Armstrong, June, 1884, *Cratty.* This is the only station known in the state but it probably occurs elsewhere in the northern portion along with *C. meadii* Dew., which is found in similar situations. Prof. Fitzpatrick collected a sedge in flower April 29, 1894, in Shelby county, which may prove to be this species.

29. C. CONOIDEA *Schkuhr.* Ried, Nacht., 67 (1806).

Illus. Flora, I, 325, fig. 770; Bailey in Gray's Man., 6th ed., 607; MacMillan, Metas. Minn. Val., 119; Tracy, Fl. Mo., 93; Brendel, Fl. Peoriana, 88.

Probably very rare within our limits; not before reported from Iowa.

Prairies near Noels, Scott county, May, 1895, *Barnes & Miller.* I also refer here an immature specimen collected by Dr. Arthur at Charles City in 1875.

30. C. OLIGOCARPA *Schkuhr.* Ried, Nacht., 58 (1806).

Illus. Flora, I, 325, fig. 771; Gray's Man., 6th ed, 607; Arthur, Cont. Fl. Iowa, III; Tracy, Fl. Mo., 94; Brendel, Fl. Peoriana, 62; Bruhin, Zwei. Nach., Fl. Wis., 644.

Rare in woods and thickets; central and eastern portion of the state. Leaves about 1 line wide, the sheaths smooth.

Hickory Grove, Scott county, May 12, 1896, *Barnes & Miller;* Rock Creek twp., Jasper county, May 29, 1886, *Norris;* Marshalltown, 1897, *Pammel.*

31. C. HITCHCOCKIANA *Dew.* Am. Jour. Sci. x. 274 (1826).

Illus. Flora, I, 325, fig. 772; Bailey in Gray's Man., 6th ed., 607; Tracy, Fl. Mo., 95; Brendel, Fl. Peoriana, 62; Bruhin, Zwei. Nach., Fl. Wis., 643.

Not before reported from Iowa, and probably rather rare within our limits. It much resembles the preceding species, from which it is distinguished by its wider leaves and pubescent sheaths.

Richland twp., Jasper county, May 29, 1886, *Norris;* High Bridge, Dallas county, July 6, 1897, *Shimek;* in woods south of Iowa Lake, Aug. 29, 1897, *Pammel & Cratty.*

32. C. MEADII *Dewey*, Sill. Jour. XLIII, 90 (1842).

C. tetanica var. *meadii* Bailey, Syn. Car. 118 (1880).

Illus. Flora, I, 327, fig. 776; Gray's Man., 6th ed., 609; Arthur, Fl. Iowa, 34; Hitchcock, Pl. Ames, 525; MacMillan, Metas. Minn., Val., 118; Tracy, Fl. Mo., 93; Brendel, Fl. Peoriana, 62; Bruhin, Fl. Wis., 279; Webber, Fl. Neb., 98; Williams, Grass and For. Pl. Daks., 43.

Common on prairies, well distributed throughout the state. This sedge is of considerable value for pasturage, being greedily eaten by cattle. An attenuate form of this collected by the author in Emmet county in 1882, and by F. W. Johnson in Poweshiek county, is the *Carex meadii* var. *bebbii* (Olney) Arthur, Cont. Fl. Iowa, V, 67 (1884). It seems to be only an occasional state caused by the plants growing among tall grasses in lower ground. The typical *C. tetanica* Schk., though reported from Iowa, has probably not yet been collected within our limits. Specimens so labelled in the I. A. C. herbarium are referred to *C. meadii* Dew. by Prof. Bailey.

Emmet county, 1878, *Cratty;* Chariton, *Shepherd;* Ames and Iowa City, *Hitchcock;* Johnson county, May, 1895, *Fitzpatrick;* Grinnell, May 25, 1885, *Norris*, and 1886, *Johnson;* Scott and Muscatine counties, 1893, common, *Barnes & Miller;* Decatur county, May, 1895, *Fitzpatrick;* Hancock county, June, 1875, *Arthur.*

33. C. LAXIFLORA *Lam.* Ency. Meth. III, 392 (1789).

Illus. Flora, I, 327, fig. 777; Gray's Man., 6th ed., 607; MacMillan, Metas. Minn. Val., 119; Tracy, Fl. Mo., 93; Brendel, Fl. Peoriana, 62; Bruhin, Fl. Wis., 279; Webber, Fl. Neb., 98; Fink, Proc. Iowa, Acad. Sci., IV, 105.

Woods, less common than the following variety. Not before reported from Iowa.

Iowa City, 1895, *Shimek;* Fayette, 1895, *Fink;* Johnson county, 1895, *Fitzpatrick;* Scott and Muscatine counties, *Barnes & Miller;* Decatur county, May, 1897, *Fitzpatrick;* Keokuk, June 1, 1897, *Shimek;* Marshalltown, May 1, 1897, *Pammel;* Ames, May 26, 1897, a form very close to the next, *Combs & Pammel.*

34. C. LAXIFLORA BLANDA (*Dew.*) *Boott.* Ill. Car. 37 (1858).

C. blanda Dewey, Am. Jour. Sci. x, 45 (1826).
C. laxiflora var. *striatula* Carey, Gray's Man., 2nd ed., 524 (1852).

Illus. Flora, 1, 327; Gray's Man., 6th ed., 607; Arthur, Fl. Iowa, 34; Tracy, Fl. Mo., 93; Rydberg, Fl. Bl. Hills, S. D., 528; Higley & Raddin, Fl. Cook Co., Ills., 134.

The most common form of the species; in woods, probably throughout the state.

Charles City, June, 1875, *Arthur;* Johnson county, 1894, *Shimek;* Jasper county, 1886, *Johnson;* Emmet county, 1885, *Cratty;* Scott and Muscatine counties, *Barnes & Miller;* Des Moines, May 15, 1897, *L. H. & Emma Pammel.*

35. C. DIGITALIS COPULATA *Bailey*, Mem. Torr. Club, 1, 47 (1889). PL. V.

Illus. Flora, 1, 328; Gray's Man., 6th ed., 608; Beal & Wheeler, Fl. Mich., 153.

Rare in the southeastern part of the state, not before reported from Iowa.

Ravines at Wild Cat Den, Muscatine county, 1896, *Barnes & Miller.* This extends its range several hundred miles to the westward, it having heretofore been reported only from Michigan and Southern Ontario. It is very probable that *C. digitalis* Willd. occurs in the state. It is a smaller plant, with very narrow leaves 1–2 lines wide.

36. C. ALBURSINA *Sheldon*, Bull. Torr. Club, XX, 284 (1893).

C. laxiflora var. *latifolia* Boott. Ill. Car. (1858) not *C. latifolia* Moench.

Illus. Flora, 1, 329, fig. 781; Gray's Man., 6th ed., 607; Arthur, Fl. Iowa, 34; Hitchcock, Pl. Ames, 524; Tracy, Fl. Mo., 93.

Moist, rich woods; common in the central, southern and eastern portions of the state. Our widest-leaved species, the plants often a foot high, with leaves 4–10 lines wide. Though long considered a variety of *C. laxiflora* Lam., it seems to be worthy of specific rank. The name *albursina*, given to it by Mr. E. P. Sheldon, is in allusion to White Bear Lake, Minnesota.

Clinton county, 1878, *Butler;* Big Grove twp., Johnson county, 1894, *Shimek;* Kellogg, 1876, *Jones;* Ames, *Hitchcock*, *Peters;* Wild Cat Den, Muscatine county, and Allen's Grove, Scott county, *Barnes & Miller;* Richland twp., Jasper county, May, 1886, *Norris;* High Bridge, Dallas county, July 6, 1897, *Shimek;* Dallas Center, 1897, a leaf specimen only, but probably this, *Rhinehart*.

NOTE.—*C. plantaginea* Lam. Encyc. III, 392 (1789), has been reported from Iowa, but I have been unable to find any authentic Iowa specimen. It closely resembles *C. albursina* Sheldon, in general appearance, but flowers before the dark green leaves are produced. It is reported from Wisconsin and Illinois.

37. C. SETIFOLIA (*Dew.*) *Britton*. Illus. Flora, I, 332, fig. 790 (1896).

C. eburnea Boott. Hook. Fl. Bor. Am. II, 226 (1840).
C. alba var. *setifolia* Dew. Am. Jour. Sci., II, 316 (1826).

Illus. Flora, l. c.; Bailey in Gray's Man., 6th ed., 610; Arthur, Fl. Iowa, 34; Hitchcock, Pl. Ames, 525; MacMillan, Metas. Minn. Val, 118; Tracy, Fl. Mo., 93; Webber, Fl Neb., 98.

Rare in woods, preferring rather dry, sloping, and well shaded ground; the fruit black and shining when fully matured, and not falling till late in the autumn.

Clinton county, 1872, *Butler;* Estherville, Emmet county, Iowa, 1882, and Armstrong, Aug. 31, 1897, *Cratty;* Jackson county, 1894, *Shimek;* Ames, *Bessey*, *Hitchcock*.

38. C. RICHARDSONI *R. Br.* Richards, App. (Frank.) Journal, 751 (1823).

Illus. Flora, I, 332, fig. 792; Gray's Man., 6th ed., 610; Arthur, Cont. Fl. Iowa, IV; MacMillan, Metas. Minn. Val., 117; Tracy, Fl. Mo., 94; Brendel, Fl. Peoriana, 62; Hale, Add. Fl. Wis., 5; Rydberg, Fl. Bl. Hills, S. D., 527.

A very rare sedge occurring in dry ground.

Grinnell, 1876, name of collector unknown, a single plant only in the I. A. C. herbarium.

39. C. PEDUNCULATA *Muhl.* Willd. Sp. Pl., IV, 222 (1805.)

Illus. Flora, I. 333, fig. 793; Bailey in Gray's Man., 6th ed., 610; Arthur, Cont. Fl. Iowa, III; MacMillan, Metas. Minn. Val., 117. Brendel, Fl. Peoriana, 88; Hale, Add. Fl. Wis., 5; Fink, Proc. Iowa Acad. Sci., IV, 105.

Dry ground in woods; rather rare in the southern and eastern portions of the state.

Clinton county, April 18, 1878, *Butler;* Fayette county, 1895, *Fink.*

40. C. PEDICELLATA (*Dew.*) *Britton*, Mem. Torr. Club, V, (1894).

C. communis Bailey, Mem. Torr. Club, I, 41 (1889).
C. varia var. *pedicellata* Dew. Am. Jour. Sci., XI, 162 (1826).
C. varia Dew. Am. Jour. Sci., XI, 102 (1826) not Muhl. (1805).

Illus. Flora, I, 333, fig. 794; Gray's Man., 6th ed., 612; Upham, Fl. Minn., 157; Brendel, Fl. Peoriana, 87; Tracy, Fl. Mo., 95.

Rare in dry soil, eastern portion of the state; not before reported from Iowa. This species much resembles *C. pennsylvanica* Lam. but unlike the latter is not stoloniferous, the fertile spikes loosely flowered, and the whole plant taller and less strict in habit. This is the *C. varia* of Gray's Manual, 5th ed., p. 692, and of most catalogues published previous to 1890. The true *C. varia* Muhl. (*C. emmonsii* Dew.) ought to be found within our limits.

Wild Cat Den, Muscatine county, 1893, and Scott county, June, 1897, *Barnes & Miller;* Muscatine, 1897, *Ball.*

41. C. PENNSYLVANICA *Lam.* Encyc. III, 388 (1789).

Illus. Flora, I, 333, fig. 795; Bailey in Gray's Man., 6th ed., 612; Arthur, Fl. Iowa, 34; MacMillan, Metas. Minn. Val., 117; Hitchcock, Pl. Ames, 525; Tracy, Fl. Mo., 94; Brendel, Fl. Peoriana, 62; Wheeler, Fl. Milwaukee County, Wis., 187; Rydberg, Fl. Sand Hills, Neb., 185; Williams, Grass and For. Pl. Daks., 43.

High prairies and woods; the most common and the earliest of our sedges, the flowers appearing in April, the fruit a month later. Strongly stoloniferous, forming small patches, and furnishing considerable early pasturage.

Emmet county, 1878 and many later collections, *Cratty;* Fayette county, 1895, *Fink;* Johnson county, 1875, *Shimek;* Charles City, May, 1874, *Arthur;* Ledyard, Kossuth county, July, 1897, *Pammel;* Iowa City, 1887, *Hitchcock;* Ames, 1891, *Rolfs;* Grinnell, 1886, *Norris;* Scott and Muscatine counties, *Barnes & Miller;* Decatur county, May, 1897, *Fitzpatrick.* Prof. C. E. Bessey in June, 1875, collected at Ames what I take to be a late flowering form of this species, with the strict leaves much exceeding the culm. The same form in flower was collected by Prof. B. Shimek in Lyon county, June, 1897. Both these may prove to be something else, but further observations and more complete material are necessary.

42. C. PUBESCENS *Muhl.* Willd. Sp. Pl., IV, 281 (1805).

Illus. Flora, I, 336, fig. 802; Gray's Man., 6th ed., 613; Arthur, Cont. Fl. Iowa, V; Hitchcock, Pl. Ames, 525; MacMillan, Metas. Minn. Val., 116; Tracy, Fl. Mo., 95; Brendel, Fl. Peoriana, 62; Wheeler, Fl. Milwaukee Co., Wis., 187.

Rare in moist woods, central and southeastern portions of the state.

Iowa City, 1887, *Hitchcock;* Jasper county, 1885, *Norris;* Scott and Muscatine counties, infrequent, *Barnes & Miller.*

43. C. JAMESII *Schwein.* Ann. Lyc., N. Y., I, 67 (1824).

C. steudellii Kunth., Enum., II, 480 (1837).

Illus. Flora, I, 337, fig. 807; Gray's Man., 6th ed., 613: Swezey's Flow. Pl. Neb., 15; Higley & Raddin, Fl. Cook Co., Ills., 136.

Rare in dry, rich woods and thickets, eastern portion of the state; not before reported from Iowa. An inconspicuous, grass-like species, the few-flowered spikes hidden among the leaves, and easily overlooked by any but an acute observer.

Wilton and Wild Cat Den, Muscatine county, June, 1895, *Barnes & Miller.*

44. C. CHORDORRHIZA *Linn. f.* Supl. 414 (1781).

Illus. Flora, I, 341, fig. 817; Bailey in Gray's Man., 6th ed., 614; Arthur, Cont. Fl. Iowa, V; MacMillan, Metas. Minn. Val., 116; Brendel, Fl. Peoriana, 88; Bruhin, Fl. Wis., 279.

Very rare in cold bogs. The long creeping rootstocks each send up numerous culms to the height of 10 to 20 inches. This is an example of a high northern plant which barely comes within our limits. Also in northern Europe.

Emmet county, in a bog two miles north of Armstrong June, 1878, the only locality known in the state. *Cratty*.

45. C. STENOPHYLLA *Wahl.* K. Acad. Handl. ser. 2, XXIV, 142 (1803). Pl. VI.

Illus. Flora, I, 341, fig. 891; Gray's Man., 6th ed., 614; Arthur, Cont. Fl. Iowa, V, No. 860a; MacMillan, Metas. Minn. Val., 115; Webber, Fl. Neb., 98; Rydberg, Fl. Bl. Hills, S. D., 527; Shimek, Proc. Iowa Acad. Sci, IV, 74.

Very dry ground on gravelly knolls. This plant, also a native of northern and central Europe, here finds its eastern limit in the United States. It ranges from Iowa to Minnesota, Nebraska, Kansas, Colorado and northward. So far as known it is the only strictly western species of the genus occurring within our limits. This is the *C. siccata* of Arthur's Cont. Fl. Iowa, V, (1882).

Estherville, June, 1882, in very dry ground, forming a dense patch on school-house block, the station since destroyed; Lyon county, Aug. 1, 1896, very old plants, the perigynia turned black, slightly larger than in the Emmet county plant. *Shimek*. In June, 1897, Prof. Shimek again collected this plant in the same locality, growing with Buffalo Grass (*Bulbilis dactyloides* (Nutt.) Raf.

46. C. CONJUNCTA *Boott.* Ill. Car., 122 (1862).

Illus. Flora, I, 342, fig. 822; Gray's Man., 6th ed., 614; Arthur, Cont. Fl. Iowa, III; Hitchcock, Pl. Ames, 525; MacMillan, Metas. Minn. Val., 115; Tracy, Fl. Mo., 93; Brendel, Fl. Peoriana, 62; Bruhin, Zwei. Nach. Fl. Wis., 643.

Rare in woods, central and southern portions of the state. Johnson county, 1895, *Shimek;* Story county, *Hitchcock;* Kellogg, June 1876, collector unknown.

47. C. STIPATA *Muhl.* Willd. Sp. Pl. IV, 253 (1805).

Illus. Flora, I, 343, fig. 823; Gray's Man., 6th ed., 614; Arthur, Fl. Iowa, 33; MacMillan, Metas. Minn. Val., 115; Tracy, Fl. Mo., 94; Brendel, Fl. Peoriana, 62; Wheeler, Fl. Milwaukee Co., Wis., 187; Rydberg, Fl. Sand Hills, Neb., 185; Williams, Grass. and For. Pl. Daks., 43; Fink., Proc. Iowa Acad. Sci., IV, 105.

Wet marshy ground, usually in woods; common throughout. The plants are very weak when growing in water, but in drier ground they are less flaccid, with narrower leaves.

Emmet county, 1882, *Cratty;* Fayette county, 1895, *Fink;* Iowa City, *Hitchcock;* Shelby county, 1894, and Johnson county, 1895, *Fitzpatrick;* Jasper county, May, 1886, *Norris;* Scott and Muscatine counties, *Barnes & Miller;* Ames, *Bessey;* Keokuk, June 1, 1897, *Shimek.*

48 C. CRUS-CORVI *Shuttlew.* Kunze, Riedg., Suppl. 128 (1844).

Illus. Flora, I, 343, fig. 824; Bailey in Gray's Man., 6th ed., 614; Arthur, Cont. Fl. Iowa, III; MacMillan, Metas. Minn. Val., 115; Tracy, Fl. Mo., 92; Brendel, Fl. Peoriana, 62; Hale, Add. Fl. Wis., 5; Webber, Fl. Neb., 98.

Low ground, southeastern section of the state; one of the most conspicuous species of the genus, and rather rare within our limits.

Clinton county, 1878, *Butler;* Page county, 1888, *Hitchcock;* borders of Muscatine slough, *Reppert;* Muscatine Island, Louisa county, Aug. 7, 1897, *Shimek & Meyers.*

49. C. TERETIUSCULA *Good.* Trans. Linn. Soc., II, 167 (1794.)

Illus. Flora, I, 344, fig. 827; Bailey in Gray's Man., 6th ed., 614; Arthur, Cont. Fl. Iowa, IV; MacMillan, Metas. Minn. Val., 114; Brendel, Fl. Peoriana, 62; Rydberg, Fl. Sand Hills, Neb., 185.

Rare in bogs; northern and central portions of the state. Also common in northern Europe.

Emmet county, 1878, *Cratty;* Ames, 1880, *Bessey;* Grinnell, 1877, *Jones.*

50. C. TERETIUSCULA PRAIREA (*Dew.*) *Britton.* Illus. Flora, 1, 344 (1896).

C. teretiuscula var. *ramosa* Boott. Ill. Car., 145 (1867), not *C. ramosa* Schk. (1806).

Illus. Flora, l. c.; Bailey in Gray's Man., 6th ed., 615; MacMillan, Metas. Minn. Val., 113; Bruhin, Fl. Wis., 278.

With the type, and probably more widely distributed. As it occurs with us it is usually coarser than the typical plant, the compound spike heavier. Not before reported from Iowa.

Estherville, Emmet county, June 25, 1881, *Cratty;* Grinnell, May, 1886, *Norris;* Story City, June 7, 1897, *Pammel & Beyers;* Granite, Lyon county, June, 1897, *Shimek;* Armstrong, 1897, *Cratty.*

51. C. GRAVIDA *Bailey.* Typ. Car. 5 (1889).

C. cephaloidea Auc. Am. in part, not of Dewey (1840).
C. gravida var. *laxifolia* Bailey, Typ. Car. 6 (1889).

Illus. Flora, 1, 345, fig. 829; Bailey in Gray's Man., 6th ed., 615; Arthur, Fl. Iowa, 33 (as *C. cephaloidea*); MacMillan, Metas. Minn. Val., 113; Webber, Fl. Neb., 98.

Low ground, woods and prairies; common throughout. and quite variable. Most of the specimens found in the upper Mississippi Valley and referred to *C. cephaloidea* previous to 1890 belong here. In rich, moist soil in woods the plants are often 2 feet or more in height, the spikes very large and heavy, the foliage lax (var. *laxifolia* Bailey). In poorer soil or on the open prairies the plants are smaller and more strict in habit. *C. alopecoidea* Tuck. has been reported from this state, but the specimens so labelled in the I. A. C. herbarium are a lax form of the above species.

Emmet county, 1878, and many later collections, *Cratty;* Iowa City, 1893-4, *Shimek;* Ames, *Hitchcock;* Grinnell, 1886, *Norris;* Scott and Muscatine counties, *Barnes & Miller;* High Bridge, Dallas county, July 6. 1897, and Grand River, June, 1890, *Shimek;* Spirit Lake, June 24, 1881, *Arthur;* Marshalltown, 1897, *Pammel.*

52. C. VULPINOIDEA *Michx.* Fl. N. Am., II, 169 (1803).

Illus. Flora, I, 345, fig. 830; Gray's Man., 6th ed , 615; Arthur, Fl. Iowa, 33; Hitchcock, Pl. Ames, 525; MacMillan, Metas. Minn. Val., 113; Tracy, Fl. Mo., 95; Bessey, Cont. Fl. Iowa, 123; Brendel, Fl. Peoriana, 62; Wheeler, Fl. Milwaukee Co., Wis., 187; Williams, Grass. and For. Pl. Daks., 42; Fink, Iowa Acad. Sci., IV, 105.

Very common in low, wet ground, the fruit a greenish brown when mature; quite variable in regard to size, usually growing in large, dense tufts, sometimes one or two feet in diameter. It is more common in ground that is occasionally flooded with water, but also occurs in quite dry soil along roadsides and in neglected places.

Johnson county, 1894, *Shimek;* Emmet county, 1878, and Spirit Lake, 1896, *Cratty;* Fayette county, 1895, *Miss Ona M. Rounds;* Greenfield, 1892, *Stewart;* Ames and Iowa City, *Hitchcock;* Webster City, 1891, *Pammel;* Hamilton county, 1891, *Rolfs;* Lucas county, *Shepherd;* Winneshiek county, July, 1896, *Fitzpatrick;* Jasper county, May, 1886, *Norris;* Johnson county, July, 1897, a very slender form, *Misses Finch & Cavanagh;* Muscatine Island, Louisa county, Aug. 1, 1897, *Shimek & Meyers;* Fort Dodge, July 5, 1897, Grand River, June, 1890, and Granite, Lyon county, June, 1897, *Shimek;* Colo, July 6, 1897, *Vernon;* Ledyard, Kossuth county, July 21, 1897, *Pammel;* Missouri Valley, June 21, 1897, and Belmond and New Albin, 1897, *Pammel;* Boone, 1897, *Steele;* Le Claire, 1897, *Rolfs;* Scott and Muscatine counties, *Barnes & Miller.*

53. C. XANTHOCARPA *Bicknell.* Bull. Torr. Club, XX, 22 (1896). Pl. VII.

Illus. Flora, I, 345, fig. 831.

This species has not heretofore been reported west of Ohio. In general appearance it quite closely resembles the preceding but differs from it in having the culms much longer than the leaves, the bracts much shorter and inconspicuous, the larger ovate-elliptic perigynia a bright yellow. Our specimens have the perigynia wider than the figure in the *Illus-*

trated Flora. Prof. Bailey, to whom I sent a specimen, kindly verified my determination.

Peru, Madison county, July 2, 1897, *D. E. Holingsworth;* Buffalo, Scott county, June 6, 1895, in dry sandy grass-land, growing in dense tufts, 3 to 4 feet high: also at Blue Grass in dry meadows, infrequent, *Barnes & Miller.*

54. C. SARTWELLII *Dew.* Sill. Jour. XLIII, 90 (1842).

C. disticha Gray's Man., 5th ed., 574 (1867) not Hudson.

Illus. Flora I, 346, fig. 833; Gray's Man., 6th ed., 615; Arthur, Fl. Iowa, 33; Hitchcock, Pl. Ames, 525; MacMillan, Metas. Minn. Val., 113; Bessey, Cont. Fl. Iowa, 124; Brendel, Fl. Peoriana, 62; Webber, Fl. Neb., 98; Williams, Grass. and For. Pl. Daks., 43.

Low prairies, not common. The plant is usually diœcious with us, the fertile and sterile plants growing in separate patches. It seems to be very tenacious of life, several patches in the author's door-yard flowering and perfecting fruit every year in the hard packed soil along with knotweed (*Polygonum aviculare* L.). The plant varies from 6 to 10 inches in height on higher ground, to 2 feet high in moister situations.

Emmet county, various collections, *Cratty;* station not given, but probably Ames, 1871, *Bessey;* Noels and Blue Grass, Scott county, 1894, *Barnes & Miller.*

55. C. ROSEA *Schkuhr.* Nacht. XV, 179 (1806).

Illus. Flora, I, 347, fig. 835; Bailey in Gray's Man., 6th ed., 616; Arthur, Fl. Iowa, 33; MacMillan, Metas. Minn. Val., 112; Bessey, Cont. Fl. Iowa, 124; Tracy, Fl. Mo., 94; Brendel, Fl. Peoriana, 62; Bruhin, Fl. Wis., 278; Webber, Fl. Neb., 98; Fink, Proc. Iowa Acad. Sci., IV, 105.

Very common throughout in woods, and occasionally on low prairies. In the latter situation the plants grow in larger stools, are more slender and lighter colored, the spikes smaller. In deep, rich woods the plants are a darker green throughout.

Charles City, July, 1875, *Arthur;* Iowa City, 1889, *Hitchcock;* Emmet county, 1896, *Cratty;* Johnson county, 1895, *Shimek;* Fayette county, 1895, *Fink;* Shelby county, 1895, and Decatur county, 1897, *Fitzpatrick;* Grinnell, 1885, *Norris;* Scott and Muscatine counties, *Barnes & Miller;* High

Bridge, Dallas county, July 6, 1897, *Shimek;* Marshalltown, May 1, 1897, No. 384, *Pammel.*

56. C. ROSEA RADIATA *Dew.* Sill. Jour. x, 276 (1826).

Illus. Flora, 1, 347; Gray's Man., 6th ed., 616; MacMillan, Metas. Minn. Val., 112; Tracy, Fl. Mo., 94; 94; Upham, Fl. Minn., 49; Higley & Raddin, Fl. Cook County, Ills., 136.

Rare, drier ground in woods. Almost capillary, spikes fewer, the 3 or 4 perigynia ascending. Not before reported from Iowa.

Johnson county, 1895, *Shimek;* Ames, 1875, *Bessey;* Iowa City, 1887, *Hitchcock;* Emmet county, Aug. 28, 1897, *Cratty;* Fort Dodge, July 5, 1897, *Shimek.*

57. C. SPARGANIOIDES *Muhl.* Willd. Sp. Pl. IV, 237 (1805).

Illus. Flora, 1, 348, fig. 839; Gray's Man., 6th ed., 616; Arthur, Fl. Iowa, 33; Hitchcock, Pl. Ames, 525; Tracy, Fl. Mo., 525; Bessey, Cont. Fl. Iowa, 124; Brendel, Fl. Peoriana, 62; Wheeler, Fl. Milwaukee County, Wis., 187.

Low ground, central, eastern and southern portions of the state; rather rare.

Charles City, June 1, 1875, *Arthur;* Ames, *Hitchcock;* Poweshiek county, July, 1888, *Norris;* Scott and Muscatine counties, *Barnes & Miller;* Decatur county, May 24, 1897, *Fitzpatrick;* Keokuk, June 1, and High Bridge, Dallas county, July 5, 1897, *Shimek.*

58. C. CEPHALOIDEA *Dew.* Rep. Pl. Mass., 262 (1840).

Illus. Flora, 1, 348, fig. 840; Bailey in Gray's Man., 6th ed., 617.

Rare, usually in quite dry ground.

Swale near Le Claire, Scott county, 1896, *Barnes & Miller.* Determined by Prof. L. H. Bailey. This is the first time so far as known to me that the true plant has been detected within our limits. Nearly all the western plants heretofore referred to this species belong to *C. gravida* Bailey.

59. C. CEPHALOPHORA *Muhl.* Willd. Sp. Pl. IV, 220 (1805).

Illus. Flora, 1, 349, fig. 841; Gray's Man., 6th ed., 617; Arthur, Fl. Iowa, 33; Hitchcock, Pl. Ames, 525; MacMillan, Metas. Minn. Val., 111; Tracy, Fl. Mo., 93; Bessey, Cont. Fl. Iowa, 124; Brendel, Fl. Peoriana, 62; Hale, Add. Fl. Wis., 5; Fink, Proc. Iowa Acad. Sci., IV, 106.

Dry ground, common except in the northern portions of the state; a very pretty species, the plant a pale green, especially the small spikes.

Ames, June, 1875, *Arthur;* Johnson county, 1894, several collections, *Shimek;* Fayette county, 1895, *Skinner;* Story county, *Hitchcock;* Muscatine, 1890, *Reppert;* Scott and Muscatine counties, *Barnes & Miller;* Louisa county, Aug. 1, 1897, *Shimek & Meyers.*

60. C. LEAVENWORTHII *Dew.* Am. Jour. Sci., 2nd ser., II, 246 (1846).

C. cephalophora var. *augustifolia* Boott. Ill. Car. 123 (1862).

Illus. Flora, I, 349, fig. 842; Gray's Man., 6th ed., 617.

Probably rare in the southwestern portion of the state. Not before reported from Iowa. This much resembles the preceding species, from which it is distinguished by its smaller size, very slender culms, and much narrower leaves, ½ to 1½ lines wide. The heads and perigynia are smaller than those of *C. cephalophora.* So far as is known to the author, this species does not occur east of the Mississippi river. The range heretofore given is from Missouri and Arkansas to Texas.

Shelby county, May 11, 1895, *Fitzpatrick.* My thanks are due Prof. Bailey for verifying my determination of this plant.

61. C. STERILIS *Willd.* Sp. Pl. IV, 208 (1805).

C. sterilis var. *excelsior* Bailey. Bull. Torr. Club, XX, 425 (1893).

Illus. Flora. I, 350, fig. 844; Gray's Man. 6th ed., 618; Arthur, Fl. Iowa, 33; Tracy, Fl. Mo., 95; Brendel, Fl. Peoriana, 62.

Moist soil, eastern portion of the state, rare.

Railroad track near Buffalo, Scott county, 1895, *Barnes & Miller.* This plant, the spikes large and approximate, differs from the type in having the perigynia much broader, 1 line long by ⅔ line wide, and rounded or sometimes slightly cordate at the base. Prof. Bailey, who refers it to his var. *excelsior*, says, "very like *C. atlantica.*" A similar form, but greener and 2 feet tall, was collected at Keokuk June 1, 1897, by Prof. Shimek, who also collected the typical form at High

Bridge, Dallas county, July 6, 1897. All specimens seen have the spikes contiguous.

62. C. INTERIOR *Bailey*. Bull. Torr. Club, XX, 426 (1893).

C. stellulata var. *scirpoides* Boott. Ill. Car. (1858).

Illus. Flora, I, 350, fig. 849; Arthur, Fl. Iowa, 33; MacMillan, Metas. Minn. Val., 111; Rydberg, Fl. Sand Hills, Neb., 185; Fink, Proc. Iowa Acad. Sci., IV, 106.

Low ground, probably throughout the state.

Emmet county, 1882, *Cratty;* Fayette county, 1894, *Fink;* Scott county, 1892, *Barnes & Miller;* Grinnell, 1885, *Norris*, and 1886, *Johnson.*

63. C. DEWEYANA *Schwein*. Ann. Lyc., N. Y., I, 65 (1864).

Illus. Flora, I, 354, fig. 856; Gray's Man., 6th ed., 619; Arthur, Cont. Fl. Iowa, V; MacMillan, Metas. Minn. Val., 110; Rydberg, Fl. Bl. Hills, S. D., 528.

Dry ground in woods; a very pretty and delicate species, closely resembling *C. bromoides* Schkuhr, from which it is distinguished by its nerveless perigynia and oblong spikes. Dr. Arthur kindly loaned me his original specimen for examination.

Spirit Lake, June 21, 1881, *Arthur.*

NOTE.—*C. bromoides* Schkuhr, has been reported from Iowa, but I have been unable to find a specimen in any of the collections examined. It is reported by Prof. Tracy in his Flora of Missouri, p. 92, and by Bruhin in his Flora of Wisconsin, p. 278.

64. C. MUSKINGUMENSIS *Schwein*. Ann Lyc., N. Y., I, 312 (1825).

C. arida Schwein. and Torr. Ann. Lyc., N. Y., I, 312 (1825).

Illus. Flora, I, 355, fig. 681; Gray's Man., 6th ed., 620; Arthur, Fl. Iowa, 33; Hitchcock, Pl. Ames, 525; MacMillan, Metas. Minn. Val., 109; Tracy, Fl. Mo., 92; Brendel, Fl. Peoriana, 62; Bruhin, Fl. Wis., 279.

Woods, eastern and central, not infrequent; a large sedge, with crowded leaves on the sterile shoots, which with the long, narrow, cylindrical spikes give the plant an appearance strikingly distinct from any of our other carices.

Ames, *Hitchcock;* banks of Wapsipinicon river, Scott county, July 8, 1896, *Barnes & Miller;* Jasper county, May, 1886, *Norris;* woodlands along the Mississippi river, Clinton and Muscatine counties, *Barnes & Miller;* Grinnell, 1877, *Jones;* Ames, July 1, 1897, *Stewart.*

65. C. TRIBULOIDES *Wahl.* K. Acad. Handl. XXIV, 145 (1803). Pl. VIII.

C. lagopodoides Schkuhr, Nacht., 20 (1806).

Illus. Flora, I, 356, fig. 862; Gray's Man., 6th ed., 620; Arthur, Fl. Iowa, 34; MacMillan, Metas. Minn. Val, 108; Bessey, Cont. Fl. Iowa, 124; Brendel, Fl. Peoriana, 62; Hale, Add. Fl. Wis., 5; Fink, Proc. Iowa Acad. Sci., IV, 106.

Low ground, usually near timber; probably throughout the state but not plentiful.

Ames and Grinnell, July 4, 1886, *Johnson:* Eldridge, Scott county, June, July, 1897, *Barnes & Miller;* Johnson county, July, 1897, *Misses Finch & Cavanagh;* Keokuk, June 1, 1897, *Shimek;* Montrose, Sept., 1883, *Arthur.*

66. C. TRIBULOIDES BEBBII (*Olney*) *Bailey.* Typ. Car., 55 (1889).

C. bebbii Olney. Exsic. II, 12 (1870).

Illus. Flora, I, 356; Bailey in Gray's Man., 6th ed., 620; MacMillan, Metas. Minn. Val., 109; Brendel, Fl. Peoriana, 88; Webber, Fl. Neb., 98; Rydberg, Fl. Bl. Hills, S. D., 528; Fink, Proc. Iowa Acad. Sci., IV, 106.

Very low ground, sloughs and margins of ponds and lakes: growing in dense tufts, the spikes clustered in a dense head. Not before reported from Iowa.

Emmet county, one mile east of Armstrong, July, 1895, *Cratty.* Two forms occur; one with more slender culms, 6 to 12 inches high, the spikes about 3 lines long: the other 2 feet high, stouter, with the spikes a third larger. An imperfect specimen collected by Mr. Skinner in 1895 at Fayette probably belongs here.

67. C. TRIBULOIDES MONILIFORMIS (*Tuck.*) *Britton.* Illus. Flora, I, 356 (1896.)

C. scoparia var. *moniliformis* Tuck. Enum. Meth., 17 (1843).

C. tribuloides var. *reducta* Bailey. Proc. Am. Acad., XXII, 118 (1886).

Illus. Flora, l. c.; Gray's Man., 6th ed., 620; Fink, Proc. Iowa Acad. Sci., IV, 106.

Southern and eastern. Not before reported from Iowa. The species and these two varieties, though widely distributed throughout the state, are probably rather rare.

Johnson county, 1888, *Miss Linder;* Fayette county, 1894, *Fink;* Spirit Lake, June 21, 1881, *Arthur.*

68. C. SCOPARIA *Schkuhr.* Riedgr. Nacht., 20 (1806).

Illus. Flora, I, 356. fig. 863; Bailey in Gray's Man., 6th ed., 620; Arthur, Fl. Iowa, 33; MacMillan, Metas. Minn. Val., 108; Brendel, Fl. Peoriana, 62; Hale, Add. Fl. Wis., 5; Bot. Surv. Neb., III, 16; Fink, Proc. Iowa Acad. Sci., IV, 106.

Woods, probably throughout the state, but reported only from the eastern half. Very variable like the rest of the group.

Penn twp., Johnson county, 1893, Cedar Rapids, 1894, and Davenport, 1895, *Shimek;* Charles City, July, 1875, *Arthur;* Eldridge, Scott county, 1897, *Barnes & Miller.*

69. C. CRISTATELLA *Britton.* Illus. Flora, I, 357 (1896).

C. cristata Schwein. Ann. Lyc. N. Y., I, 66 (1824) not Clairv. (1811).
C. straminea var. *cristata* Tuck. Enum. Meth., 18 (1843).
C. lagopodioides var. *cristata* Carey; Gray's Man., 1st ed., 545 (1848).

Illus. Flora, l. c., fig. 865; Gray's Man., 6th ed., 620; Arthur, Fl. Iowa, 34; Hitchcock, Pl. Ames, 525; MacMillan, Metas. Minn. Val., 109; Tracy, Fl. Mo., 93; Brendel, Fl. Peoriana, 62; Bruhin, Fl. Wis., 278; Webber, App. Fl. Neb., 23.

Low ground along streams, margins of lakes, and edges of woods. Throughout but not plentiful.

Emmet county, rare, Aug., 1890, *Cratty;* Ames, *Hitchcock;* Scott and Mascatine counties, *Barnes & Miller;* Decatur county, 1897, *Fitzpatrick;* Mt. Pleasant, Oct. 1, 1887, *Dr. Mitte.*

70. C. FŒNEA *Willd.*, Enum. 957 (1809).

C. adusta Gray's Man., 5th ed., 580 (1867), not of Boott.

Illus. Flora, I, 357; fig. 867; Gray's Man., 6th ed., 621; MacMillan, Metas. Minn. Val., 108; Brendel, Fl. Peoriana, 88.

Rare on moist prairies, central and eastern parts of the state.

Eldridge, Scott county, June, 1897, *Barnes & Miller.* Regarding this collection Prof. Bailey writes Mr. Barnes: "Very like *C. silicea* Olney." Ames, June 14, 1897, (fide Boott); Belmond, 1897, a doubtful form with the inner face smooth, *Pammel*.

71. C. FŒNEA PERPLEXA *Bailey;* Mem. Torr. Club, 1, 27 (1889).

Illus. Flora, 1, 357; Bailey in Gray's Man., 6th ed., 621.

Rare on prairies; not before reported from Iowa.

Buffalo, Scott county, June, 1896, *Barnes & Miller*. Cæspitose in habit, the culms 1½ to 3 feet high, spikes 3 to 6, more aggregated larger and more truncate at the base than in type, the perigynia not strongly nerved on the outer face, and smooth or very obscurely nerved on the inner. Spirit Lake, June 24, 1881, *Arthur*. This latter is the *C. adusta* of Arthur's catalogue. It seems to be identical with the Scott county plant which was determined by Prof. Bailey.

72. C. STRAMINEA *Willd.* Schkuhr. Riedgr. 49 (1801).

Illus. Flora, 1, 358, fig. 868; Bailey in Gray's Man., 6th ed., 621; Arthur, Cont. Fl. Iowa, 111; MacMillan, Metas. Minn. Val., 106; Tracy, Fl. Mo., 94; Brendel, Fl. Peoriana, 62; Rydberg, Fl. Sand Hills Neb., 185; Fink, Proc. Iowa Acad. Sci., IV, 106.

Woods and prairies; the typical plant seems to be rather scarce. This and the related species and varieties run together inextricably, and form a most perplexing group.

Fayette county, 1895, *Fink;* Scott county, June, 1897, *Barnes & Miller;* Emmet county, a form common on dry prairies with stiffer culms, 10 to 20 inches high, and larger spikes and perigynia, closely approaching *C. festucacea* Willd., *Cratty;* Decatur county, July, 1897, *Fitzpatrick;* Granite, Lyon county, June, 1897, *Shimek;* Spirit Lake, June 4, 1881, *Arthur*.

73. C. STRAMINEA MIRABILIS (*Dew.*) *Tuck.* Enum. Meth., 18 (1843).

C. mirabilis Dew. Sill. Jour., XXX, 63 (1836).

Illus. Flora, 1, 358; Bailey in Gray's Man., 6th ed., 621; MacMillan, Metas. Minn. Val., 107; Upham, Supl. Fl. Minn., 49; Webber, Fl. Neb., 98.

Rare in low ground; central portion of the state.

Ames, June 1, 1877, *Arthur*, and another collection, *Johnson;* Poweshiek county, July 4, 1886, *Johnson;* Charles City, July, 1875, *Arthur*.

74. C. TENERA *Dew.* Am. Jour. Sci., VIII, 97 (1824).

C. straminea var. *aperta* Boott, Ill. Car. 120 (1862).
C. straminea var. *tenera* Bailey, Bot. Gaz. x, 381 (1885).

Illus. Flora, I., 358, fig. 870; Gray's Man., 6th ed., 622; Bruhin, Zwei. Nach. Fl. Wis., 643; Williams, Grass and For. Pl. Daks., 43; Higley & Raddin, Fl. Cook Co., Ills., 138.

Rare in low ground.

Spirit Lake, June 21, 1881, *Arthur;* Emmet connty, 1884, *Cratty;* Johnson county, May 28, 1894, *Shimek;* Ames, *Carver;* Jasper county, 1886, *Norris*.

Part of the above are not typical, but seem best referred here. The perigynia are broader than would appear from the figure in the *Illustrated Flora*. In the Emmet and Johnson county plants the spikes are 3 to 5, light colored, the upper two usually contiguous. Dr. Arthur collected a large form at Ames which appears to connect this with the next.

75. C. FESTUCACEA *Willd.* Sp. Pl., IV., 242 (1825).

C. straminea var. *brevior* Dew. Sill. Jour. XI., 158 (1826).

Illus. Flora, I., 359, fig. 871; Gray's Man., 6th ed., 622; Arthur, Fl. Iowa, 34, and Cont. Fl. Iowa, V.; MacMillan, Metas. Minn. Val., 106; Bruhin, Zwei, Nacht, Fl. Wis, 643; Webber, App. Fl. Neb., 23; Williams, Grass & For. Pl. Daks., 43; Higley & Raddin, Fl. Cook Co., Ills., 138.

Common on prairies everywhere throughout the state; very variable.

Charles City, June 29, 1875, *Arthur;* Lyon county, 1896, and Johnson counny, 1894–5, *Shimek;* Iowa City, 1889, *Hitchcock;* Hamilton county, 1891, *Rolfs;* Lucas county, *Shepherd;* Emmet county, 1896, *Cratty;* Ames, 1897, *Arthur;* Eldridge, June, 1897, *Barnes & Miller;* Spirit Lake, 1881, *Arthur;* Decatur county, Aug., 1897, *Fitzpatrick;* Lyon county, 1897, and Keokuk, June 1, 1897, *Shimek;* Charles City, June, 1874, *Arthur;* Des Moines, May 17, 1897, *L. H. & Emma Pam-*

mel: Fort Dodge, July 5. 1897. *Shimek;* Missouri Valley, June 21, 1897, a form approaching the next species, *Pammel.*

A form collected by Prof. Hitchcock at Ames is labeled "var. *brevior*, approaching var. *alata*" by Prof. L. H. Bailey. Similar forms were collected at Charles City by Dr. Arthur. and at Eldridge. Scott county, June. 1897. by Messrs. Barnes & Miller. This latter plant is the *C. straminea* var. *ferruginea* Bailey, Bull. Torr. Club, XX., 421 (1893).

76. C. ALATA *Torr.* Ann. Lyc. N. Y., III., 396 (1826).

C. straminea var. *alata* Bailey. Cat. Car., (1884).

Illus. Flora, I., 359, fig. 872; Gray's Man., 6th ed. 622; Hitchcock, Pl. Ames, 525; Higley & Raddin, Fl. Cook Co., Ills., 138.

Low ground, rare within our limits. The specimens have the perigynia slightly narrower, the beak a little longer than in the eastern plant.

Ames, *Hitchcock;* a specimen in the I. A. C. herbarium labelled "Iowa, June 23, 1871, *Bessey:*" Grinnell, June, 1886, an intermediate form which I refer here, *Norris.*

77. C. BICKNELLII *Britton.* Illus. Flora, I., 360, fig. 874 (1896).

C. straminea var. *crawii* Boott, Ill. Car. 121 (1862), not *C. crawii* Dew. (1846), which is an accepted species.

Illus. Flora, l. c.; Bailey in Bull. Torr. Bot. Club., XX., 421; Arthur, Flora Iowa, 34, no. 881; Rydberg, Fl. Bl. Hills, S. D., 527.

Rare and uncharacteristic with us. The broadly winged perigynia shell off very easily when mature. Usually but few plants are found in a place, and those very loosely tufted.

Emmet county, 1878, *Cratty;* Johnson county, 1894, *Shimek,* and Ames, June 16, 1877, *Arthur.* The two latter I refer here with some hesitation. Keokuk, June 1, 1897, a form with the beak one-half the length of the body of the perigynium, *Shimek.*

78. C. SYCHNOCEPHALA *Carey.* Sill. Jour., ser. 2, IV., 24 (1847). Pl. IX.

Illus. Flora, I., 360, fig. 875; Gray's Man., 6th ed., 622; MacMillan, Metas. Minn. Val., 106; Bruhin, Zwei, Nach. Fl. Wis., 643; Beal & Wheeler, Fl. Mich., 157.

Rare in sloughs and on the margins of ponds and lakes. Not before reported from Iowa. This sedge usually grows in dense tufts, erect, 6 to 18 inches high, but numerous clumps with prostrate culms 2 feet long were found growing with the type one mile east of Armstrong, July, 1896. This plant seems to thrive best on land which is flooded during the spring.

Emmet county, July 12, 1891, *Cratty;* Spirit Lake, July 30, 1896, *Cratty & Shimek.*

APPENDIX.

Since the manuscript for this paper was placed in the hands of the printer considerable material, illustrating geographical distribution, has been received which it is desirable to include. Owing to a misunderstanding regarding the scope of the paper, a considerable amount of material belonging to the genera preceding *Carex*, was not placed in my hands in time to insert the data in the proper place in the body of the paper. The greater portion of the material here used was collected by Prof. Shimek of the Iowa State University, and by Prof. C. R. Ball of the State College of Agriculture, to both of whom I am deeply indebted for the generous assistance they have so freely given me.

It has been found necessary to withhold a small amount of material for further study and observation.

P. 318.

Cyperus rivularis Kunth; Forest City, 1895, and Johnson county, July, 1895, *Shimek.*

P. 319.

C. inflexus Muhl.; Johnson county, Sept. 1894, *Shimek.*

P. 319.

C. schweinitzii Torr.; Muscatine, Oct., 1896, Clear Lake, Cerro Gordo county, July, 1896, and Johnson county, 1894, *Shimek;* Jackson county, 1895, *P. Bartsch;* Winneshiek county, *H. Goddard;* Vinton, June, 1898, *Ball;* Muscatine, Aug., 1897, a peculiar form closely approaching *C. filiculmis* in general appearance.

P. 319.

C. acuminatus Torr. & Hook.; Sioux City, *Hitchcock.*

P. 320.

C. esculentus L.; Iowa City, *Hitchcock;* Clayton county, June, 1895, and Des Moines county, Aug., 1895, *Paul Bartsch;* Hamburg, 1898, *Shimek;* Ames, July, 1897, *Ball;* Lebanon, July, 1898, *Ball & Sample.*

P. 321.

C. speciosus L.; Johnson connty, 1889, Miss Linder; Lyon county, Aug., 1896, *Shimek;* Van Buren county, July, 1898, *Ball.*

P. 321.

C. strigosus L.; Forest City, July, 1896, *Shimek;* Des Moines county, *Paul Bartsch.*

P. 322.

C. strigosus compositus Britton; sandy river bottoms, Johnson county, Sept., 1894, *Shimek.*

P. 322.

C. filiculmis Vahl.; Keokuk, July, 1895, and Johnson county, July, 1895, *Shimek;* Winneshiek county, June, 1895, *H. Goddard.*

P. 324.

Eleocharis ovata (Roth.) R. & S.; Lyon county, June, 1897, *Shimek.*

P. 324.

E. palustris (L.) R. & S.; Spirit Lake, Aug., 1896, and Davenport, 1895, *Shimek;* Pottawattamie county, June 3, 1897, *J. E. Cameron.*

P. 325.

E. acicularis (L.) R. & S.; Lake Edwards, Hancock county, 1895, Johnson county, 1895, Forest City, July, 1896, Cedar Rapids, June, 1894, and Rock Rapids, Aug., 1896, *Shimek.*

P. 326.

E. tenuis (Willd.) Schultes; Iowa City, *Macbride;* Lyon county, June, 1897, *Shimek.*

P. 328.

Scirpus americanus Pers.; Ames, June, 1897, *Meeker & Ball.*

P. 329.

Scirpus lacustris L.; Clear Lake and Hancock county, July, 1896, *Shimek;* Mt. Pleasant, *J. H. Mills;* Pottawattamie county, June, 1897, *J. E. Cameron;* Albin, July 1, 1898, *Ball.*

P. 329.

S. fluviatilis (Torr.) Gray; Hancock county, July 17, 1896, *Shimek;* Ames, June, 1898, *Ball & Sample.*

P. 330.

S. atrovirens Muhl.; Mt. Pleasant, July 7, 1898, Muscatine, July 4, 1898, and Vinton, June, 1898, *Ball;* Rock Rapids, 1896, Forest City, July 17, 1896, Mason City, July, 1896, Iowa City, June, 1894, Keokuk, July, 1895, and Grand River, June, 1890, *Shimek;* Mt. Pleasant, *J. H. Mills;* Winneshiek county, June 13, 1896, *H. Goddard.*

P. 330.

S. lineatus Mich.; Minerva, June, 1898, and Van Buren county, *Ball;* Wilsonville, July 7, 1895, *H. C. Taylor;* Cedar Rapids, *Hitchcock.*

P. 332.

Hemicarpha micrantha (Vahl.) Britton; sandy river bottoms, Johnson county, Sept., 1894, *Shimek.*

P. 333.

Scleria triglomerata Mich; Monroe county, July 13, 1898, *Ball.*

P. 336.

Carex lupulina L.; Keokuk, July, 1895, *Shimek;* Dubuque, July 17, 1895, *Paul Bartsch.*

P. 336.

C. monile Tuck.; Story City, June 4, 1898, *Ball.*

P. 338.

C. comosa Boott; Muscatine, Sept., 1892, *Shimek.* A peculiar form with the two upper spikes nearly sessile.

P. 339.

C. typhinoides Schwein.; Dubuque, July 17, 1895, *Paul Bartsch.*

P. 339.

C. trichocarpa, Muhl.; Vinton, June 29, 1898, *Ball.*

P. 340.

C. shortiana Dew.; Muscatine, July 4, 1898, *Ball;* Keokuk, July 5, 1895, *Shimek.*

P. 341.

C. lanuginosa Mich.; Story City, June, 1898, *Ball & Sample.*

P. 343.

C. davisii Schwein. & Torr.; Ames, June, 1898, *Ball.*

P. 344.

C. longirostris Torr.; Mason City, July 7, 1896, *Shimek.*

P. 344.

C. grisea Wahl.; Garwin, June 29, 1898, and Ames, June 20, 1898, *Ball.*

P. 346.

C. hitchcockiana Dew.; Keokuk, July 5, 1895, and Johnson county, May, 1894, *Shimek.* The latter plant has the leaves as well as the sheaths pubescent, the perigynia scabrous. A specimen of this from the same locality, collected later in the season would be interesting.

P. 347.

C. laxiflora blanda (Dew.) Boott; Forest City, July 17, 1896, *Shimek.*

P. 347.

C. albursina Sheldon; Jackson county, Aug., 1894, *Shimek.*

P. 349.

C. pennsylvanica Lam.; Ames, 1898, *Ball.*

P. 352.

C. stipata Muhl.; Cedar Rapids, May 15, 1898, *Shimek.*

P. 353.

C. gravida Bailey; Lebanon, July 11, 1898, *Ball.*

P. 354.

C. vulpinoidea Mich.; Ames, June 20, 1898, Minerva, June, 1898, Muscatine, July, 1898, and Vinton, June, 1898, *Ball;* Davenport, Forest City, July 18, 1896, Rock Rapids, Lyon county, Aug. 5, 1898, and Mason City, July 6, 1896, *Shimek.*

P. 354.

C. xanthocarpa Bicknell. What I take to be this species was collected by Prof. Shimek at Cedar Rapids, June 7, 1894. The lower branch is one in. long; otherwise much like the type.

P. 355.

C. rosea Schk.; Cedar Rapids, May 15, 1896, *Shimek;* Garwin, June 29, 1898, Ball.

P. 356.

C. rosea radiata Dew; Lebanon, July 11, 1898, *Ball & Sample;* Ames, June, 1898, nearly this, *Ball & Sample.*

P. 356.

C. sparganioides Muhl.; Iowa City, 1894, *Shimek;* Ames, June 3, 1898, *Ball.*

P. 356.

C. cephalophora Muhl.; Ames, June, 1898, *Ball & Sample.*

P. 358.

C. muskingumensis Schwein.; Muscatine, Sept., 1896, *Shimek.*

P. 359.

C. tribuloides Wahl.; Ames, June, 1898, *Ball.* Prof. Shimek collected near Mason City a form intermediate between this and *C. tribuloides bebbii.*

P. 359.

C. tribuloides moniliformis (Tuck.) Britton; Ames, June 20, 1898, *Ball.*

P. 360.

C. scoparia Schk.; Vinton, June 29, 1898, *Ball.*

P. 360.

C. cristatella Britton; Vinton, June 29, 1898, *Ball.*

P. 360.

C. adusta Boott. Prof. Shimek collected at Rock Rapids, Lyon county, Aug., 1896, what appears to be this species. Further observation is needed.

C. fœnea Willd on p. 360.

P. 362.

C. tenera Dew.; Forest City, July 18, 1896, nearly this, *Shimek.*

P. 362.

C. festucacea Willd.; Cedar Rapids, May 15, 1896, and Rock Rapids, Aug., 1896, *Shimek;* Monroe county, July, 1898, *Ball.*

P. 363.

C. bicknellii Britton; Ames, June 21, 1898, *Ball.*

SUMMARY.

Cyperus, species and varieties,	13
Dulichium,	1
Eleocharis,	9
Stenophyllus,	1
Fimbristylis,	1
Scirpus,	7
Eriophorum,	2
Hemicarpha,	1
Scleria,	1
Carex,	78
Genera,	10
Species and varieties,	114

Table showing the sedge flora of Iowa and the neighboring states from which each species and variety has been reported:

IOWA.	Minn.	Wis.	Ills.	Mo.	Kans.	Neb.	S. D.
Cyperus diandrus,	x	x	x	x	x	x	
rivularis,	x		x	x		x	
inflexus,	x	x	x	x	x	x	x
schweinitzii,	x	x	x	x	x	x	x
acuminatus,			x	x	x	x	x
erythrorhizos,	x	x	x	x	x		x
esculentus,	x	x	x	x		x	
speciosus,	x	x	x	x	x		x
strigosus,	x	x	x	x	x	x	
strig. capitatus,							
strig. compositus,							
strig. robustior,							
filiculmis,	x	x	x	x	x	x	
Dulichium arundinaceum,	x	x	x	x	x	x	
Eleocharis atropurpurea,						x	
ovata,	x	x	x	x		x	
palustris,	x	x	x	x	x	x	x
pal. glaucescens,	x		x			x	
acicularis,	x	x	x	x	x	x	x
wolfii,			x				
tenuis,	x	x	x	x	x		
acuminata,	x		x	x	x		
intermedia,	x	x	x	x	x		
Stenophyllus capillaris,	x	x	x	x	x	x	
Fimbristylis autumnalis,			x	x	x		
Scirpus hallii,			x	x			
americanus,	x	x	x	x	x	x	x
lacustris,	x	x	x	x	x	x	x
fluviatilis,	x	x	x	x	x	x	x
atrovirens,	x	x	x	x	x	x	x
lineatus,	x	x	x	x	x		
cyperinus,	x	x	x		x		
Eriophorum polystachyon,	x	x	x				
gracile,	x	x	x	x	x	x	
Hemicarpha micrantha,	x		x	x	x	x	
Scleria triglomerata,		x	x		x		
Carex intumescens,	x	x	x	x			
asa-grayi,		x	x		x		
lupulina,		x	x	x			
monile,	x	x	x	x			
tuckermani,	x	x	x	x			

IOWA.	Minn.	Wis.	Ills.	Mo.	Kans.	Neb.	S. D.
Carex retrorsa,	x		x				x
lurida parvula,							
hystricina,	x	x	x	x	x	x	
comosa,	x	x	x			x	
squarrosa,	x	x	x	x	x	x	
typhinoides,			x	x			
trichocarpa,	x	x	x	x	x	x	
aristata,	x	x	x	x		x	x
riparia,	x	x	x	x	x		
shortiana,			x	x	x	x	
lanuginosa,	x	x	x		x	x	x
filiformis,	x	x	x	x	x	x	
fusca,	x	x	x		x		
stricta,	x	x	x	x	x		x
stric. angustata,					x		x
haydeni,		x	x	x	x	x	x
limosa,	x	x	x			x	
davisii,	x	x	x	x	x		
longirostris,	x	x	x		x	x	x
grisea,	x	x	x	x	x	x	
amphibola,							
granularis,	x	x	x	x	x	x	
crawei,	x	x	x			x	
conoidea,		x	x	x	x		
oligocarpa,		x	x	x			
hitchcockiana,		x	x	x	x		
meadii,	x	x	x	x	x	x	x
laxiflora,	x	x	x	x	x	x	
lax. blanda,	x	x	x	x	x		x
digitalis copulata,							
albursina,	x		x	x			
setifolia,	x	x		x	x	x	
richardsoni,	x	x	x	x	x		x
pedunculata,	x	x	x				
pedicellata,	x	x	x	x	x		
pennsylvanica,	x	x	x	x	x	x	x
pubescens,	x	x	x	x			
jamesii,			x	x		x	
chordorrhiza,	x				x	x	x
stenophylla,	x				x	x	x
conjuncta,	x	x	x	x	x		
stipata,	x	x	x	x	x	x	x
crus-corvi,	x	x	x	x	x	x	
teretiuscula,	x		x		x	x	
teret. prairea,	x	x					
gravida,	x		x		x	x	
vulpinoidea,	x		x	x	x	x	x
xanthocarpa,							
sartwellii	x	x	x			x	x
rosea,	x	x	x	x	x	x	
rosea radiata,	x		x	x	x		
sparganioides,		x	x	x	x		
cephaloidea,			x		x		
cephalophora,	x	x	x	x	x		

IOWA.	Minn.	Wis.	Ills.	Mo.	Kans.	Neb.	S. D.
Carex leavenworthii,				x			
sterilis,		x	x	x	x		
interior,	x	x	x	x		x	
deweyana,.	x	x			x		x
muskingumensis,	x	x	x	x			
tribuloides,	x	x	x	x			
trib. bebbii,			x			x	x
trib. moniliformis,	x						
scoparia,	x	x	x		x	x	
cristatella,	x	x	x	x	x	x	
fœnea,	x		x				
fœnea perplexa,	x						
straminea,.	x	x	x	x	x	x	
stram. mirabilis,	x		x	x	x	x	
tenera,		x	x		x		x
festucacea,	x	x	x		x	x	x
alata,			x				
bicknellii,	x		x	x			
sychnocephala,	x	x					

From the above table the following statements are deduced:

Species common to the whole group	10
Iowa species reported from Minnesota	89
" " " " Wisconsin	84
" " " " Illinois	96
" " " " Missouri	77
" " " " Kansas	78
" " " " Nebraska	57
" " " " S. Dakota	32

Per cent. of Iowa sedges in Minnesota	78
" " " " " " Wisconsin	74
" " " " " " Illinois	85
" " " " " " Missouri	67
" " " " " " Kansas	68
" " " " " " Nebraska	50
" " " " " " S. Dakota	28

INDEX.

[SYNONYMS IN ITALICS.]

CAREX *adusta* Gray. . 333, 360, 369
alata *Torr.* 363
albursina *Sheldon.* . 347, 367
amphibola *Steud.* . . . 344
aperta Boott 342
aquatilis *Wahl.* 343
arida Schwein. & Torr. . 358
aristata *R. Br.* 340
asa-grayi *Bailey.* . . . 335
bicknellii *Britton* . 363, 369
blanda Dew. 347
bromoides *Schkuhr.* . . 358
buxbaumii Wahl. . . . 341
cephaloidea *Dew.* . . . 356
cephalophora *Muhl.* 356, 368
cephalophora angustifolia Boott 357
chordorrhiza *Linn. f.* . 350
communis Bailey. . . . 349
comosa *Boott* . . 338, 367
conjuncta *Boott* 351
conoidea *Schkuhr.* . . . 345
crawei *Dewey.* 345
cristata Schwein. . . . 360
cristatella *Britton* . 360, 369
crus-corvi *Shuttlew.* . . 352
davisii *Schw. & Torr.* 343, 367
deweyana *Schwein.* . . 358
digitalis copulata *Bailey.* 347
disticha Huds. 355
eburnea Boott 348
festucacea *Willd.* . 362, 369
filiformis *L.* 341
fil. latifolia Boeckl. . . . 341
fil. lanuginosa Michx. . . 341
fœnea *Willd.* 360
CAREX fœnea perplexa *Bailey* 361
fusca *All.* 341
granularis *Muhl.* . . . 344
gravida *Bailey* . . 353, 368
grav. laxifolia Bailey . . 353
grayi Carey. 335
grisea *Wahl.* . . . 344, 367
gris. angustifolia Boott . 344
haydeni *Dew.* 342
hitchcockiana *Dew.* 346, 367
houghtonii *Torr.* . . . 341
hystricina *Muhl.* . . . 338
interior *Bailey* 358
intumescens *Rudge.* . . 335
jamesii *Schwein.* . . . 350
lagopodioides Schkuhr. . 359
lanuginosa *Michx.* . 341, 367
laxiflora *Lam.* 346
laxiflora blanda *Boott.* 347, 367
lax. latifolia Boott . . . 347
lax. striatula Boott . . . 347
leavenworthii *Dew.* . . 357
limosa *L.* 343
longirostris *Torr.* . 344, 367
lupulina *Muhl.* . . 336, 366
lurida parvula (*Paine*) *Bailey* 337
meadii *Dew.* 346
meadii bebbii (Olney) Arthur 346
mirabilis Dew. 361
monile *Tuck.* . . . 336, 366
muskingumensis *Sch.* 358, 368
oligocarpa *Schkuhr.* . . 345
pedicellata (*Dew.*) *Britton* 349
pedunculata *Muhl.* . . 349

Carex pennsylvanica *Lam.* 349, 367
pseudo-cyperus *L.* 338
pseudo-cyp. comosa Boott 338
pseudo-cyp. americana Hoch. 338
pubescens *Muhl.* 350
retrorsa *Schwein.* 337
richardsoni *R. Br.* 348
riparia *W. Curtis* 349
rosea *Schkuhr.* 355, 368
rosea radiata *Dew.* 356, 368
sartwellii *Dew.* 355
scoparia *Schkuhr.* 360, 368
setifolia (*Dew.*) *Britton* 348
shortiana *Dew.* 340, 367
sparganioides *Muhl.* 356, 368
squarrosa *L.* 338
squarrosa typhinoides Dewey 339
stellulata scirpoides Boott 358
stenophylla *Wahl.* 351
sterilis *Willd.* 357
steudellii Kunth. 350
stipata *Muhl.* 352, 367
straminea *Willd.* 361
stram. mirabilis (*Dew.*) *Tuck.* 361
stram. alata Bailey. 363
stram. aperta Boott 362
stram. brevior Dew. 362
stram. crawei Boott 363
stram. tenera Bailey. 362
stricta *Lam.* 342
stricta angustata *Bailey.* 342
stricta decora Bailey. 342
sychnocephala *Carey.* 363
tenera *Dew.* 362, 369
teretiuscula *Good.* 352
ter. prairea (*Dew.*) *Britton.* 353
ter. ramosa Boott 353
tetanica meadii Bailey. 346
tribuloides *Wahl.* 359, 368
trib. bebbii (*Olney*) *Bailey.* 359
trib. moniliformis (*Tuck.*) *Britton* 359, 368

Carex *trib. reducta* Bailey 359
trichocarpa *Muhl.* 339, 367
trich. aristata (R. Br.) Bailey 340
trich. deweyi Bailey. 339
trich. imberbis Gray 339
trich. læviconica (Dew.) Hitch. 339
tuckermani *Dew.* 337
typhinoides *Schwein.* 339, 367
vulpinoidea *Mich.* 354, 368
xanthocarpa *Bicknell.* 354, 368

Cladium mariscoides (*Muhl.*) *Torr.* 333

Cyperus. 318
acuminatus *T. & H.* 319, 365
aristatus Bœckl. 319
diandrus *Torr.* 318
dian. castaneus Torr. 318
erythrorhizos *Muhl.* 320
esculentus *L.* 320, 365
filiculmis *Vahl.* 322, 365
inflexus *Muhl.* 319, 364
michauxianus Gray. 321
phymatodes Muhl. 320
rivularis *Kunth.* 318, 364
schweinitzii *Torr.* 319, 364
speciosus *L.* 321, 365
strigosus *L.* 321, 365
strig. capitatus *Bœckl.* 322
strig. compositus *Brit.* 322, 365
strig. robustior *Kunth.* 322

Dulichium. 323
arundinaceum (*L.*) *Britt.* 323
spathaceum Pers. 323

Eleocharis. 323
acicularis (*L.*) *R. & S.* 325, 365
atropurpurea (*Retz.*) *Kunth.* 324
acuminata (*Muhl.*) *Nees.* 326
compressa Sulliv. 326
engelmanni *Steud.* 324
intermedia (*Muhl.*) *Schultes.* 326
ovata (*Roth.*) *R. & S.* 324, 365
palustris (*L.*) *R. & S.* 324, 365

ELEOCHARIS pal. glaucescens *Gray*. 325
tenuis (*Willd.*) *Schult.* 326, 366
wolfii *Gray* 326
ERIOPHORUM. 331
cyperinum L. 330
gracile *Koch*. 332
lineatum Benth. & Hook. 330
polystachyon *L*. . . . 331
HEMICARPHA. 332
micrantha (*Vahl.*) *Brit*.332, 366
subsquarrosa Nees. . . 335
FIMBRISTYLIS. 327
autumnalis (*L.*) *R. & S.* 327
capillaris A. Gray . . 327
castanea (*Mich.*) *Vahl.* . 328
RHYNCHOSPORA. 332
alba (*L.*) *Vahl*. 332
capillacea (*Mich.*) *Vahl*. . 332
SCIRPUS. 328
americanus *Pers*. . 328, 366
atrovirens *Muhl*. . 330, 366
cyperinus (*L.*) *Kunth*. . 330
fluviatilis (*Torr.*) *Gray*.329, 366
hallii *Gray* 328
lacustris *L*. . . . 326, 366
lineatus *Michx*. . . 330, 366
pungens Vahl. 328
supinus hallii Gray. . . 328
tenuis (Willd.) 326
triangularis (Pers.) MacMillan. 328
validus Vahl. 329
SCLERIA. 333
triglomerata *Michx*. 333, 366
STENOPHYLLUS. 327
capillaris (*L.*) *Britton*. . 327

EXPLANATION OF PLATE I.

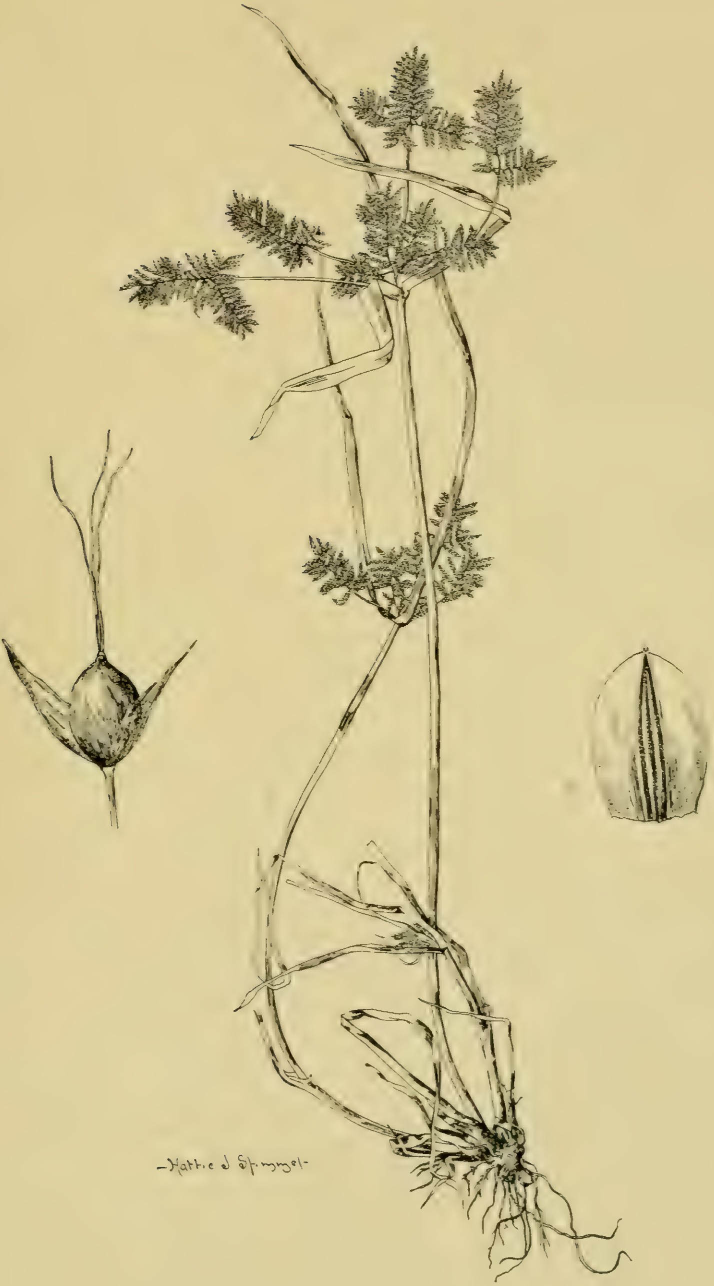
Cyperus erythrorhizos Muhl., p. 320.

Whole plant × $\frac{1}{2}$.

Immature akene, with a pair of the detached rachis wings. × 12. (The mature akene is sharply triangular.)

A single scale × 12.

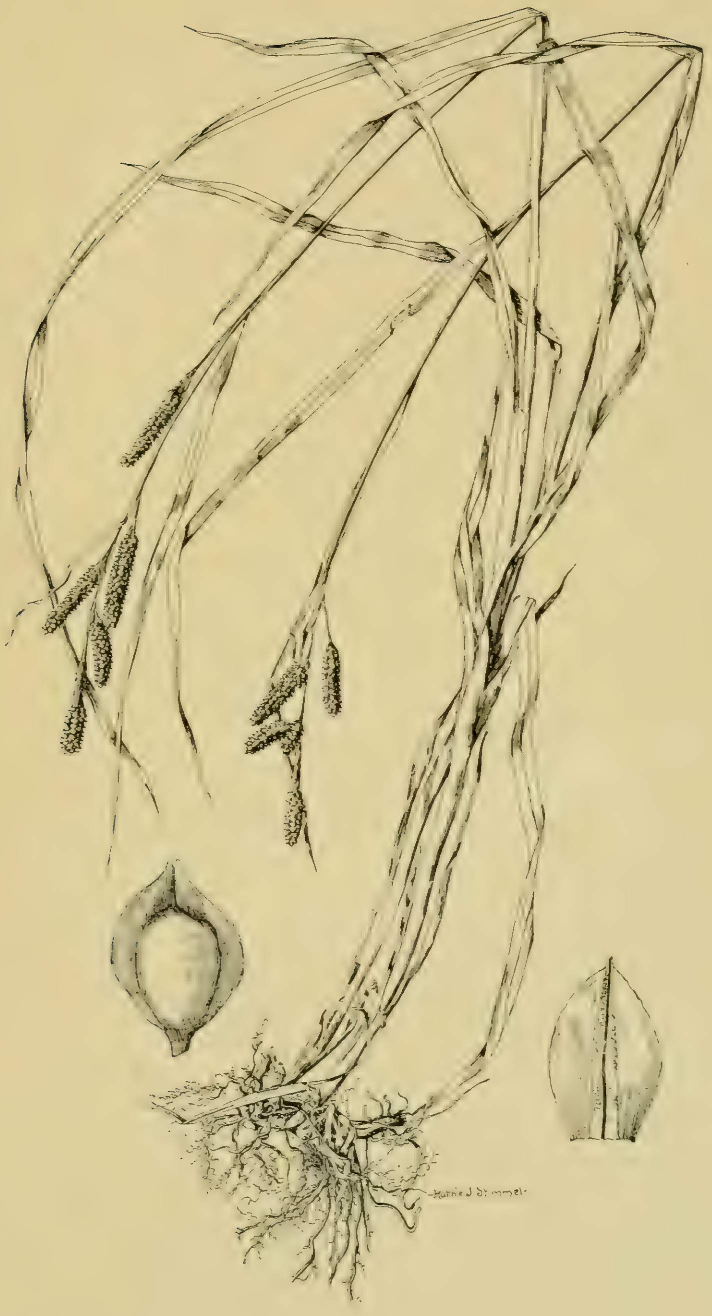
PLATE I.


-Hattie J Stimmel-

EXPLANATION OF PLATE II.

Carex shortiana Dew., p. 340.
Whole plant × $\frac{2}{5}$.
Perigynium × 11.
(This should show slight transverse wrinkles.)
A single scale × 11.

PLATE II.


-Harriet Stimmel-

EXPLANATION OF PLATE III.

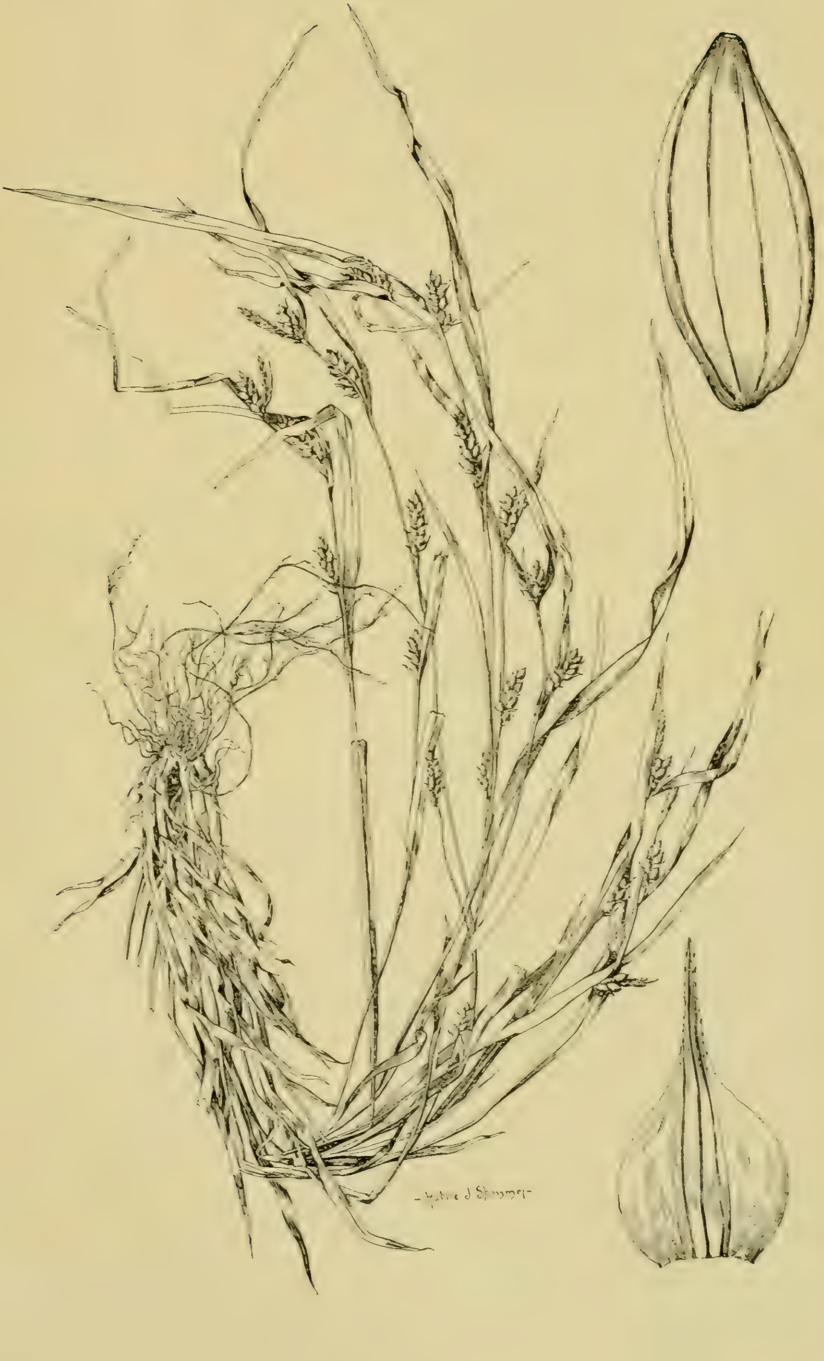
Carex amphibola Steud., p. 344.

Whole plant × $\frac{1}{3}$.

Perigynium and scale, each × 9.

PLATE III.

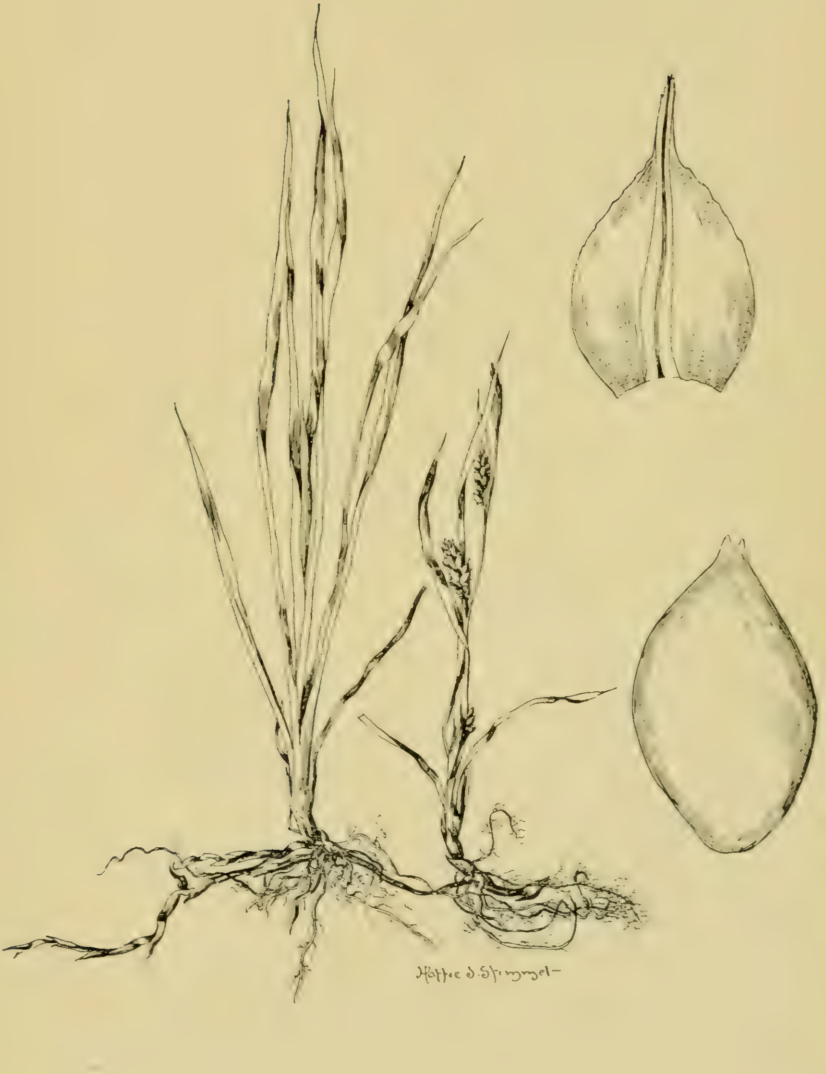
Pl. III



EXPLANATION OF PLATE IV.

Carex crawei Dew., p. 345.
Whole plant × ½.
Perigynium and scale, each × 12.

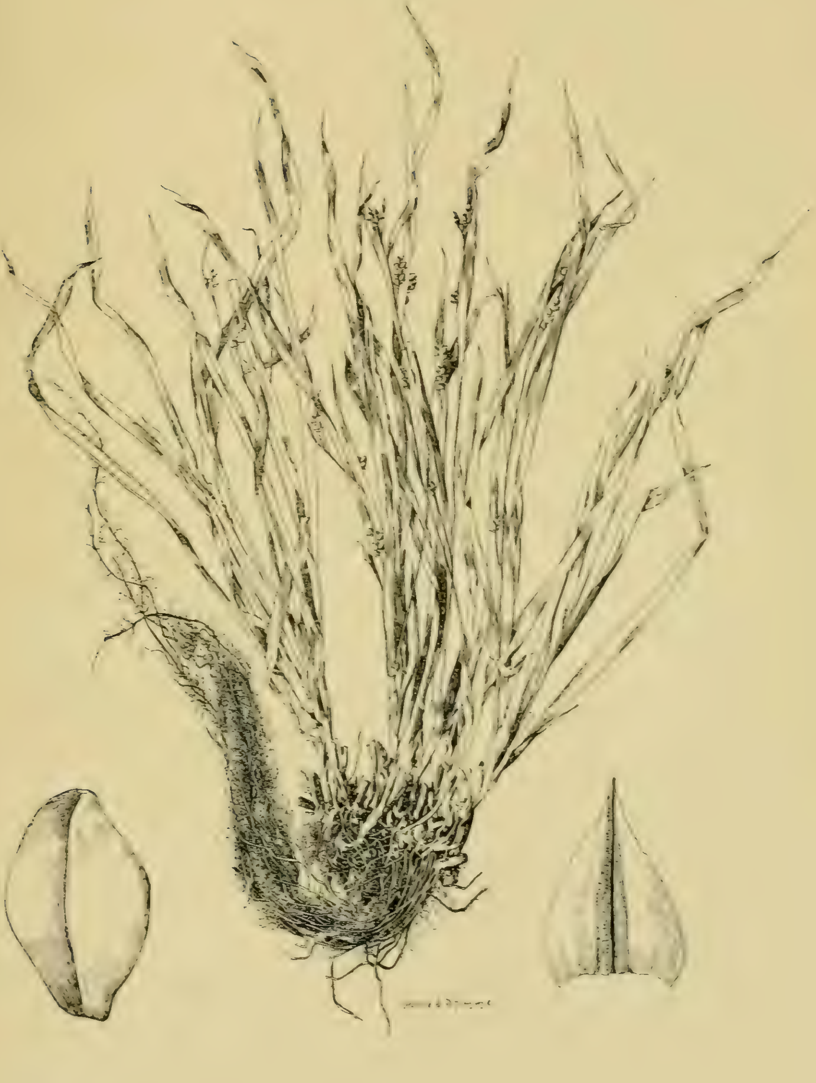
PLATE IV.


Hattie J. Stimmel

EXPLANATION OF PLATE V

Carex digitalis copulata Bailey, p. 347.
Whole plant × $\frac{2}{5}$.
Perigynium and scale, each × 11.

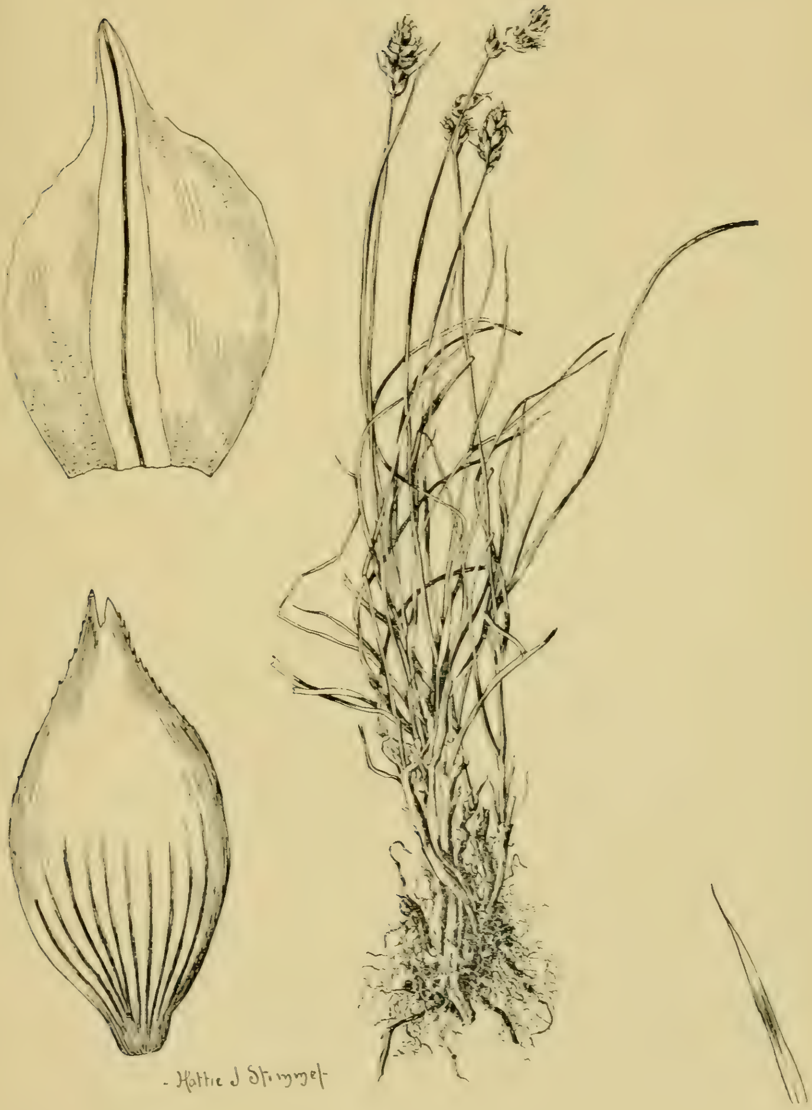
PLATE V.



EXPLANATION OF PLATE VI.

Carex stenophylla Wahl., p. 351.
Whole plant × $\frac{2}{3}$.
Perigynium and scale, each × 16.

PLATE VI.


Hattie J Stimmel

EXPLANATION OF PLATE VII.

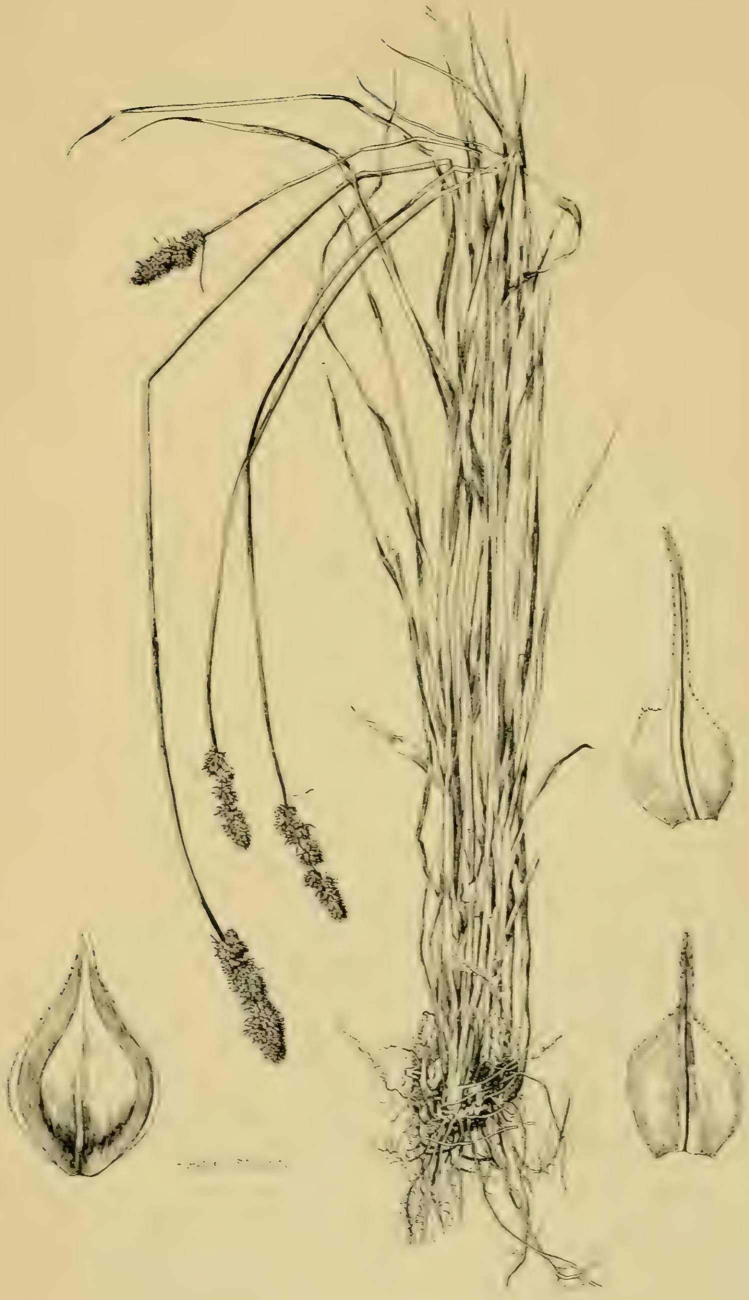
Carex xanthocarpa Bicknell, p. 354.

Whole plant × $\frac{2}{5}$.

Perigynium × 11.

Two scales; the upper long-awned scale from the basal portion of the spikelet, the lower from the middle of the spikelet, each × 11.

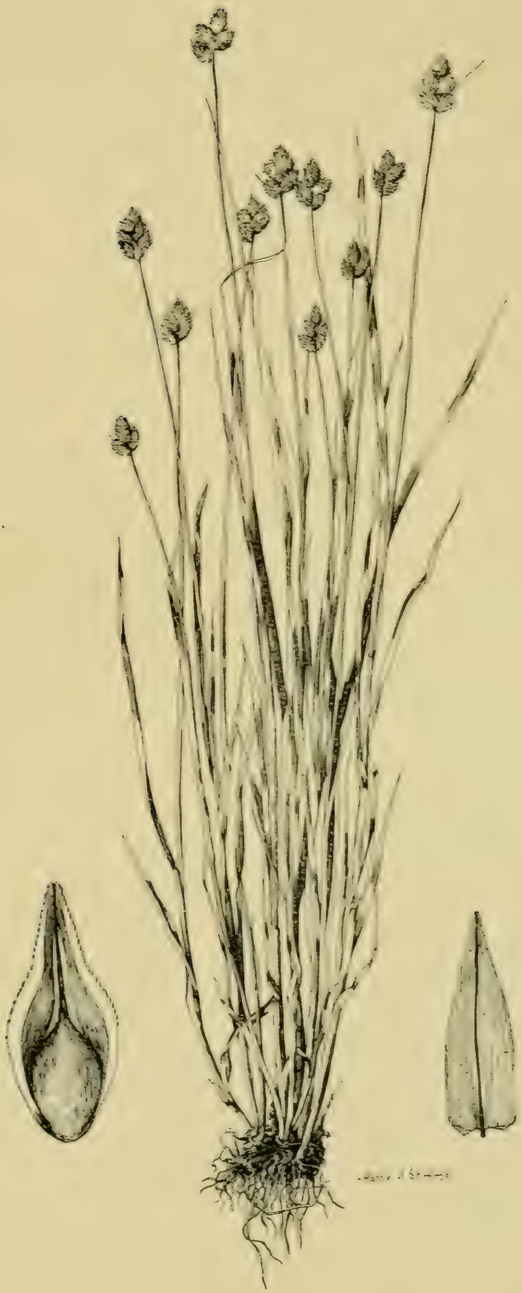
PLATE VII.



EXPLANATION OF PLATE VIII.

Carex tribuloides bebbii (Olney) Bailey, p. 359.
Whole plant × $\frac{2}{5}$.
Perigynium and scale, each × 11.
The reference in the text, p. 363, should be after No. 66 instead of No. 65.

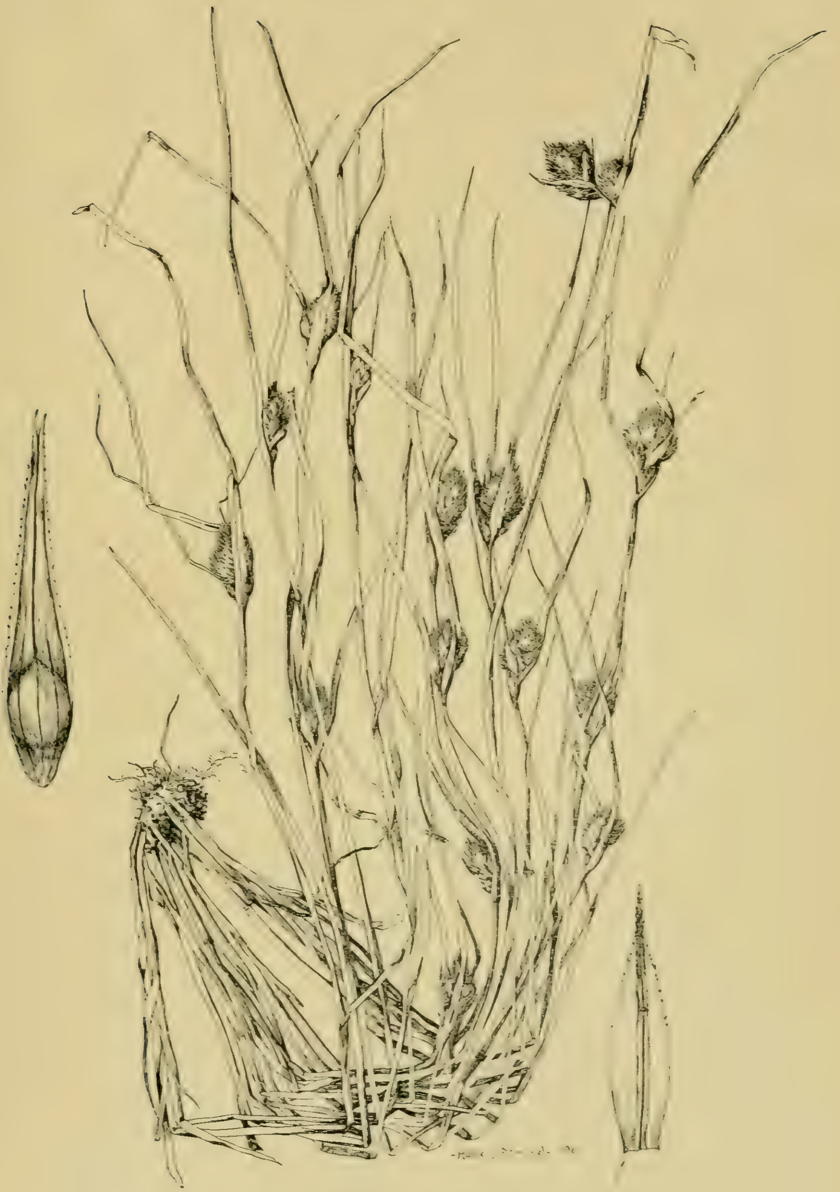
PLATE VIII.



EXPLANATION OF PLATE IX.

Carex sychnocephala Carey, p. 363.
Whole plant × $\frac{1}{3}$.
Perigynium and scale, each × 9.

PLATE IX.



EXPLANATION OF PLATE X.

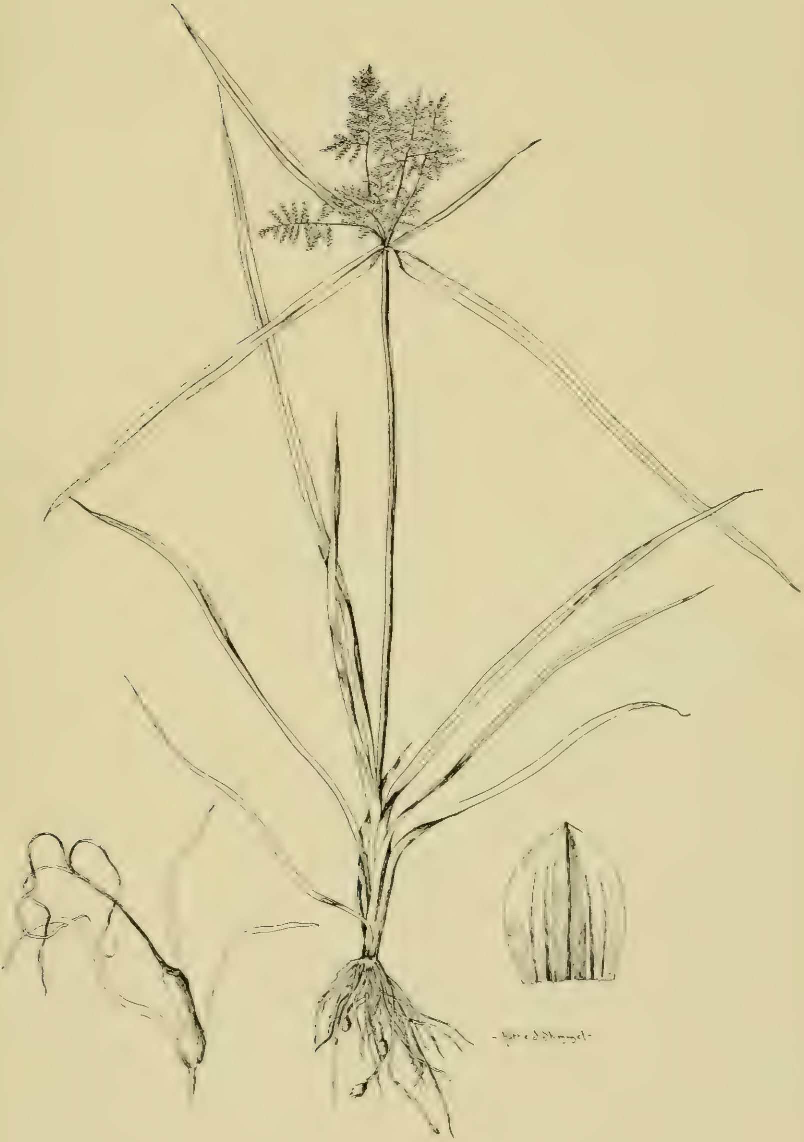
Cyperus esculentus L., p. 320

Whole plant × $\frac{1}{3}$.

Immature akene, with the three filaments from which the anthers have fallen, × 9.

A single scale × 9.

PLATE X.



DESCRIPTIONS OF AMERICAN UREDINEÆ, II.

By J. C. ARTHUR and E. W. D. HOLWAY.

The second fascicle of UREDINEÆ EXSICCATÆ ET ICONES, upon which the following descriptions and comments are based, includes only grass forms, *i. e.*, species whose uredospores and teleutospores occur upon the *Gramineæ* as host plants. The first fascicle of this series, containing *Lepto-uredineæ*, was issued September, 1894, and the descriptions of species included were subsequently published in this journal (3:44-57).

Every collection in the distribution is illustrated by drawings of the spores, these being numbered upon the plates to correspond with the number of the packet. Arabic numbers are used to designate the species, and letters to designate the several collections under each species. The plates are issued both with the EXSICCATÆ and the DESCRIPTIONS.

The drawings have in all cases been made directly from the material of the distribution, and are drawn to a uniform scale. The forms of spores chosen for illustration are those most commonly seen under the microscope, with an occasional deviation to show one-celled forms among species of *Puccinia*, and to show uredospores found in teleutosori gathered late in the season. The attempt has been made to represent the form of the spores, thickness of walls, and other details, as faithfully as possible, but this could not be carried out as fully as desired in the case of the sculpturings upon the surface of the spores, as they are in all instances too minute to be accurately drawn upon the scale adopted. It has also been impossible to fully indicate the number and position of the germ-pores of the uredospores in very many cases, especially when the spores were those found among the teleutospores, the material having often been collected after more or less of the winter had passed. The pores shown are those actually seen, and although their position is believed to be accurate, they are often less than the full number belonging to the spore. They have usually been drawn from preparations untreated with acids or other clearing reagents.

A certain amount of inaccuracy, or at least undesirable deviation, exists in descriptions of uredospores due to their being seen in all possible positions. If they had pedicels or a sufficiently elongated form, they would lie upon their sides, as most teleutospores do, and their outline would present greater uniformity and be more readily interpreted. A few species, *e. g.*, *Puccinia vilfæ*, have uredospores with apex and base conspicuously dissimilar, but in most species the scar left by the falling away of the pedicel is the only orienting mark. In the drawings the basal scar is indicated whenever it could be made out, and in all such instances the spore is placed upright on the plate.

A word of explanation, and possibly of defense, may be needed to justify the abandonment of the time-honored and familiar names of *P. graminis* and *P. coronata* for unfamiliar ones, which the strict application of the law of priority has brought forward. Protests have been made from time to time by able students of the order against the recognition of the æcidial stage, and possibly of the uredo stage, in the selection of the oldest name. These protests are based in part upon the difficulty of identifying earlier names applied to these stages, and the consequent instability of such a foundation for nomenclature. But experience does not seem to bear out the inference that the teleutosporic stage alone possesses such marked superiority for specific identification. It is unfortunately true that much doubt often attaches to the application of early names, but an arbitrary contraction of the domain to be covered by the law of priority does not seem to the writers to be the right way to meet the difficulty.

Many important investigations by students of the order during the last three or four years have well established what has been a growing conviction for a decade or more, that the whole order has attained such a high degree of specialized parasitism that the particular species of the host plant, and often the particular part of the host bearing the rust, is an item of the utmost importance in identification. Thus it is no longer considered sufficient to say that a certain rust occurs "on various grasses," but the particular species must be named. Furthermore, it is advisable to say what part of the plant is affected, for instance *Puccinia panici* occurs on one side of the leaf blade, while *Uromyces graminicola* occurs on both sides and also on the sheaths and culms of the same host; *Puccinia poculiformis* and *Puccinia rubigo-vera* often grow on the same host, but the former chiefly affects the sheaths and culms, while the latter occupies the leaf blade. It has also been established that in some cases heterœcismal species having uredo and teleutospores with slight morphological distinctions, yet bear their alternate stage upon very different species of host plants. In such species the æcidial characters are a highly important part of the complete diagnostic description.

With the growing recognition of the value of a knowledge of the host and of the æcidial form in circumscribing the species, has come an awakening regarding the highly important nature of the uredo for providing additional diagnostic characters. It was not until the uredo stage was studied that the very distinct species, *Puccinia phragmitis* and *P. magnusiana*, both upon *Phragmites communis*, were separated. This is a case in which the uredospores can be distinguished with ease and certainty, but the teleutospores unassociated with uredo are scarcely distinguishable. The two common, but usually confounded, species on *Andropogon scoparius* are even a better illustration. Other cases of a similar nature could be cited.

The development of our conception of the species to include the several forms or stages and the specific nature of the parasitism, as requisite elements in establishing diagnostic characters in uredineous plants, has left no footing, so it seems to us, for the old view which exalted the teleutosporic stage, and left the other factors out of consideration. We do not, therefore, agree with Dr. Magnus, who said (*Bot. Centr.* 37:289) some time ago regarding the specific matter in debate, that he held it "incorrect to form such names as *Puccinia poculiformis* (Jacq.) Wettst. for *Puccinia graminis* Pers." We prefer to yield to what we consider an unpleasant necessity, and recognize a condition which we believe not only more justly and accurately represents the present state of our knowledge but tends to a more secure and stable nomenclature. We feel as did Dr. Wettstein, when he made the first change of this nature that was made (*Pilzflora der Steiermark*, p. 18), one that now seems likely to be followed in many instances, and especially for most of the gramineous and cyperaceous species. He said (translated into English): "Although it is hard to drop a name, which has become so generally established as the name *Puccinia graminis*, yet I feel compelled to do it. There is no doubt that Jacquin described the *Æcidium* of this species in 1786, l. c., as his cited illustration also affirms. The species-name "*poculiforme*," under which Jacquin described this *Æcidium* as a *Lycoperdon*, is consequently the oldest name, certainly older than Persoon's, which he established in the year 1797, in the *Tent. Dispos. Meth. Fung.*, p. 39."

Other matters pertaining to the present paper, such as the quotation of the original description of the species, the addition of an emended description when deemed advantageous, the elevation of the number and position of the germ-pores of the uredospores as valuable diagnostic characters, the rather incomplete citation of exsiccati, etc., are probably sufficiently self-explanatory to be passed over without comment.

Numbers one to seventeen were described in a previous article in this journal (3:44), and the present article includes numbers eighteen to thirty-four.

---

18. UROMYCES ALOPECURI *Seym.* (1889. Proc. Bost. Soc. Nat. Hist. 24:186.)

18*a*. On *Alopecurus geniculatus fulvus* (Sm.) Scrib. Vermilion Lake, Minn., *Holway*.

18*b*. On *Alopecurus geniculatus fulvus* (Sm.) Scrib. Vermilion Lake, Minn., *Holway*.

ORIG. DESC. "II. Sori epiphyllous, small, scattered, inconspicuous, mostly covered by the epidermis; spores subglobose to elliptical; epispore rather thick, warty; size 12-20×15-24 μ.

III. Sori epiphyllous, small, blackish, covered by the epidermis; spores obovate to elliptical, broadly rounded or truncate at the apex, 17-23×23-32 μ; epispore of nearly equal thickness throughout; pedicel persistent, as long as the spore or shorter."

On *Alopecurus geniculatus* var. *aristatus;* Brainerd, Minn."

II. Sori light brown, hypophyllous and to a less extent on sheaths and culms, oblong or linear, scattered, inconspicuous, tardily naked, ruptured epidermis prominent: uredospores subglobose to elliptical-ovate, pale yellowish when desiccated, 18-26×15-22 μ; wall rather thick, closely warty; pores minute, several (6-8?), scattered.

III. Sori hypophyllous extending to sheaths and culms, irregularly oblong, effused, varying to punctiform, covered with the persistent epidermis, grayish black: teleutospores subglobose to sub-pyriform, light brown, smooth, 15-22×22-26 μ; wall thin: apex rounded or truncate, slightly if at all thickened: base rounded or inclined to wedge-shaped: pedicel slender, colored, usually shorter than the spore.

A northern species, apparently not very common. The gross appearance of the teleutosori is very similar to that of the same sori of *Puccinia rhamni.*

---

19. UROMYCES GRAMINICOLA Burr. (1884. Bot. Gaz. 9: 188.)

19*a*. On *Panicum virgatum* L. Rockport, Kans., *Bartholomew.*
19*b*. On *Panicum virgatum* L. Decorah, Iowa, *Holway.*
19*c*. On *Panicum virgatum* L. Rockport, Kans., *Bartholomew.*

ORIG. DESC. "II and III. Sori amphigenous, but more common on under surface, scattered, small, oblong or linear, soon uncovered, the ruptured epidermis ragged, but usually its remains plainly apparent; uredospores spheroidal or oval, minutely echinulate, 15-18×18-23 μ; teleutospores variable, subglobose, oval or oblong, smooth, apex rounded or angular, thickened, 12-18×21-30μ; pedicel somewhat colored, thick, scarcely tapering below, once to twice the length of the spore."

A quite common species, with prominent sori, when well developed. The brown uredosori sometimes thickly cover one or both surfaces of the leaf, but are rarely confluent, or much elongated. The uredospores are brown, evenly and minutely papillose, but not strictly echinulate, pores small, scattered, apparently four to six. The characters which distinguish the uredospores of this species from those of *Puccinia panici* are all slight, and chiefly relate to the size and echinulation.

The teleutosori are black, prominent, much elongated, frequently as abundant on sheaths and culms and even the panicle as on the leaf blades. When well developed there is considerable resemblance in gross appearance to *Puccinia poculiformis*. In large sori the pedicels of the teleutospores are usually very long, attaining 75 to 100 μ.

The spores of *Puccinia panici* are often found upon the same leaf blades, and confuse the collector.

EXSIC.

Ellis and Everhart, N. A. F. 1865.
Carleton, Ured. Amer. 1.
Kellerman and Swingle, Kans. Fungi 48.
Rabenhorst-Winter, Fungi Europæi 3410.
Rouméguere, Fungi Selecti Exsic. 5125.
Ellis and Everhart, Fungi Columb. 547.

20. PUCCINIA PANICI *Diet.* (1895. Erythea 3: 80.)

20*a*. On *Panicum virgatum* L. Rockport, Kans., *Bartholomew*.
20*b*. On *Panicum virgatum* L. Decorah, Iowa, *Holway*.
20*c*. On *Panicum virgatum* L. Decorah, Iowa, *Holway*.

ORIG. DESC. "Uredo: Spots yellowish, indefinite; sori epiphyllous, very minute, oblong, surrounded by the burst epidermis, brown. Uredospores broadly elliptical or globose, densely echinulate, brown, 25-31 ×25-29 μ. Teleutospores: sori epiphyllous, pulvinate, black, small, oblong or linear. Teleutospores oblong or clavate, apex thickened, rounded or conical, base rounded or attenuated, central constriction slight, 29-48×15-21 μ, brown. Pedicels of different length, on an average as long as the spores."

A seemingly restricted species and not often collected, being generally inconspicuous and easily overlooked. The teleutosori, which are rarely confluent, are unusually small, often mere points, and are often arranged in evident lines. Their minuteness and position only on the upper surface of the leaf make it possible when well developed to separate it with considerable certainty, without the use of a lens, from *Uromyces graminicola* and from *Puccinia virgata*, both inhabiting the same host.

Single-celled teleutospores in the same sorus with the usual form are not rare, and in shape and coloring closely resemble the teleutospores of *Uromyces graminicola*. The uredospores of the two species also look much alike, but those of the *Puccinia* are slightly larger, and possess more prominent echinulation. The echinulation on the uredospores of the latter is somewhat irregular, but for the most part thickly covers the spores. The pores are small and difficult to detect, scattered, and apparently four to six in number.

EXSIC.

Ellis and Everhart, N. A. F. 3048.
Ellis and Everhart, Fungi Columb. 264.

---

21. PUCCINIA FLACCIDA *B. & Br.* (1873. Jour. Linn. Soc. Bot. 14: 91.)

21*a*. On *Panicum crus-galli* L. Rooks Co., Kans., *Bartholomew*.

ORIG. DESC. "821. P. FLACCIDA *B. & Br.* Soris parvis brevibus; sporis flaccidis, pedicello longo hyalino, obtusis, medio contractis (No. 1136). On *Panicum*. Peradeniya. Spores .004 long, with pedicels .009."

II, III. Sori amphigenous, scattered, punctiform or oblong, tardily naked, ruptured epidermis conspicuous. Uredospores globose to broadly ovate or elliptical, brown, 22-30 μ in diameter, echinulate, pores 4-6, evident, scattered. Teleutospores of the usual type few, oblong or fusiform-clavate, 17-20 × 35-40 μ, apex narrowed and thickened; most of the teleutospores of a great variety of forms due to the septum being placed at all angles, even vertical, and the two cells seemingly merely adpressed, or the upper adhering to the lower, 19-26 × 30-38 μ, wall thin, smooth, apices of both cells thickened, bases of both cells narrowed, often acute, paler brown than the uredospores; pedicel 50-75 μ long, hyaline.

A rather inconspicuous species, remarkable for the strange construction of the teleutospores. It was first detected in this country by Burrill, who vouches (Par. Fungi of Ills., p. 202) for the identity of our species with that of the East Indies, described by Berkeley and Broome in their "Enumeration of the Fungi of Ceylon." It has been found in Nebraska (*Williams*), Illinois and Indiana.

EXSIC.

Seymour and Earle, Econ. Fungi 60.
Ellis and Everhart, N. A. F. 3576, 1836.
Ellis and Everhart, Fungi Columb. 1187.

22. PUCCINIA ESCLAVENSIS *Diet. & Holw.* (1897. Bot. Gaz. 24: 29.)

22*a*. On *Panicum bulbosum* H. B. K. Hot Springs, N. M., *Holway*.
22*b*. On *Panicum bulbosum* H. B. K. City of Mexico, Mex., *Holway*.

ORIG. DESC. "Sori on both sides of the leaves, but mostly epiphyllous, small to medium sized, globose to linear, often confluent on the stems; uredosori cinnamon-brown; spores elliptical, ovate, or globose, 30 to 43x24-33 μ, yellow-brown to chestnut-brown, very closely covered with small warts, and with 4 equatorial germ-pores; teleutosori black-brown, pulvinate, naked; spores elliptical, rarely obovate, not at all or only slightly constricted, rounded at both ends, apex with a broad-hooded thickening, 32-41x23-28 μ, smooth, dark chestnut-brown; pedicel up to 160 μ long, hyaline."

The great similarity of the uredo- and teleutospores in form, size and color, and the remarkably long hyaline pedicels of the latter, make this a notable species. The sori often occur in dense masses, especially upon the stem and the branches of the inflorescence. The walls of both kinds of spores are quite thick. Smaller, more globose, paler and thinner walled uredospores occur sparingly among those of the usual form, and might easily be mistaken for an admixture of another species, as they appear to be mature and viable. The apical thickening of the teleutospores is not a prominent feature, and is sometimes absent.

23. PUCCINIA EMACULATA *Schw.* (1834. N. Am. Fungi, p. 295.)

23*a*. On *Panicum capillare* L. Decorah, Iowa, *Holway*.
23*b*. On *Panicum capillare* L. Lafayette, Ind., *Lillian Snyder*.
23*c*. On *Panicum capillare* L. Lafayette, Ind., *Wm. Stuart*.
23*d*. On *Panicum capillare* L. Decorah, Iowa, *Holway*.
23*e*. On *Panicum holciforme* Steud. (*Berchtoldia holciformis* Fourn.) Tula, Mex., *Holway*.

Orig. Desc. "2912. 8. P. emaculata, L. v. S., passim in foliis Panicorum, praesertim Panici pubescentis in campis Bethl. et Philad. P. omnino emaculata; primum acervis totis tectis rarioribus sparsis erumpentibus; demum saepe confluentibus, minutis, abbreviatis, angustis, parallelis, utrinque plerumque acuminatis. Sporidiis aterrimis, minoribus; aquae immersis, fuscescentibus."

SYN:

Puccinia graminis brevicarpa Peck. (1873. 25th Rep. N. Y. Mus. p. 122.)

II and III. Sori chiefly epiphyllous but also amphigenous, usually numerous, small, oblong, pulverulent, early naked, ruptured epidermis prominent. Uredospores light brown, globose or nearly so, 20-24 μ in diameter, epispore rather thin, thickly echinulate, pores 4, not usually equatorial. Teleutospores oblong-clavate to elliptical, chestnut-brown, smooth, scarcely constricted at middle, apex obtuse or rounded, much thickened, base narrowed 18-22×20-45 , pedicel one to one and a half times the length of the spore and colored like it.

A very abundant species. As here characterized it does not include *Puccinia windsoriæ* on *Tricuspis seslerioides*, or *P. triodiæ* on *Tricuspis purpurea*. It appears to extend throughout the North American continent. The specimens examined from Mexico (on *Panicum holciforme*) show a rich development of uredo, but only a few teleutospores and no teleutosori.

The uredospores are discharged from the sori so plentifully as to form a brown powder over the surface of the leaf. The blackish teleutosori are thickly scattered over the leaf surfaces, and become especially conspicuous on the bleached leaves in winter.

EXSIC.

Ellis, N. A. F. 1029.
Carleton, Ured. Amer. 37.
Kellerman and Swingle, Kans. Fungi 15.
Seymour and Earle, Econ. Fungi 58a, 58b, 58c, 59.
Ellis and Everhart, Fungi Columb. 492.
Rabenhorst-Winter, Fungi Europæi 3616.

---

24. Puccinia cryptandri *E. & B.* (1897. Erythea 5: 47.)

24*a*. On *Sporobolus cryptandrus* (Torr.) Gr. Rockport, Kans., *Bartholomew*.

ORIG. DESC. "Puccinia cryptandri. On leaves of Sporobolus cryptandrus. Sept. 16, 1896 (No. 2264). Epiphyllous, uredosori linear, 1 mm–1 cm long, narrow, bordered by the longitudinally cleft epidermis, light brown. Uredospores globose, 20-24 μ diam., or elliptical, 25-30×20-23 μ yellowish brown, faintly aculeate. Teleutospores in sori like those of the uredospores, but mostly shorter, oblong-elliptical, yellow-brown, constricted at the septum, 35-45×20-23 μ. Epispore smooth, scarcely or only slightly thickened at the apex. Pedicels as long or longer than the spores. II. Very abundant wherever the host occurs, from July to October. III. Very rare. Differs from Puccinia sporoboli Arth*. principally in its longer and darker colored uredosori. In that species they are a bright orange."

The teleutospores of this species are much like those of the rust on *Sporobolus asper*, but the teleutosori are not so prominent and the habit of the uredosori is widely different, as well as the form and color of the uredospores.

Collections made in Nebraska and Kansas show a scarcity of teleutospores, and this may be true of the whole region east of the Rocky Mountains. Specimens in the herbarium of the Division of Veg. Physiology and Pathology at Washington, D. C., collected at Cañon City, Colo., by S. M. Tracy (Aug. 23, 1887), and at Willis, Madison Co., Mont., by F. W. Anderson (Oct., 1888), however, show luxuriant development of teleutospores, with only a few scattering uredospores, but with enough of the latter to make the determination of the species unquestionable. A probable explanation of this diversity of habit is that the æcidium does not occur upon the plains east of the mountains, but is abundant westward.

The history of this species is a fine illustration of the inability of collectors to recognize some species from the teleutospores alone; for it was ten years after good material of the teleutosporic stage was under observation, and not until the uredoform was forced upon their attention, that it was separated, and then almost wholly upon the evidence of the uredospores.

---

25. PUCCINIA SPOROBOLI *Arth.* (1884. Bull. Iowa Agric. Coll. : 159.)

---

*The species intended is Puccinia vilfæ A. & H.

25*a*. On *Sporobolus heterolepis* Gr., Decorah, Iowa, *Holway*.

Orig. Desc. "II. Uredospores yellow, round, minutely roughened, 24 to 28 mmm. in diameter.

III. Sori on the leaves and stem, oblong or linear, brownish black, early naked; encircling epidermis not very conspicuous; teleutospores oblong to oblong-clavate, smooth, somewhat or not at all constricted in the middle, deep brown at least above, 15 to 21 mmm. broad by 28 to 45 mmm. long; apex thickened, semi-circular to obtuse; base acutish or less often obtuse; pedicel rather stout, as long or shorter than the spore, colored.

On Sporobolus heterolepis Gr. Ames, Spirit Lake, Decorah."

II. Uredospores yellow, round, echinulate, 24-30 µ in diameter, pores 5 or more, not equatorial.

III. Sori oblong or linear, amphigenous, brownish black, early naked, ruptured epidermis scarcely evident; teleutospores oblong to oblong-clavate, somewhat or not constricted in the middle, 28-45 × 17-22 µ, apex semi-circular to obtuse, thickened sometimes as much as 8 µ, base narrowed, epispore rather deep yellowish brown, smooth. Pedicel colored, about as long as the spore.

The type material of this seemingly rare species, which is in the herbarium of the author of the species, has been carefully re-examined*. The material, from which the characters of the species were drawn, was collected at Decorah, Iowa, on Sept. 18, 1884, by E. W. D. Holway. Three other collections, made at Ames and Spirit Lake of the same state, were erroneously assigned to the species, and gave rise to the comments, which follow the description, regarding the presence of one-celled teleutospores. The characters as given for the one-celled form in reality belong to *Uromyces graminicola*, the host being in fact *Panicum virgatum* and not a *Sporobolus*. One-celled spores in the true *P. sporoboli* have not yet been observed. So far as the authors know the species has only been collected at Decorah, Iowa, and good uredo material has not yet been seen.

---

* It is probable that duplicate type material is in the herbarium of the Iowa Agricultural College, but many of the sheets containing grass forms have been withdrawn and for the time being are inaccessible, and a careful examination of the remainder of the uredineous herbarium, kindly loaned by Professor L. H. Pammel, has not revealed it.

26. PUCCINIA VILFÆ *n. nom.*

26*a*. On *Sporobolus asper* (Mx.) Kunth. (*Vilfa aspera* B.) Rockport, Kans., *Bartholomew*.

26*b*. On *Sporobolus asper* (Mx.) Kunth. (*Vilfa aspera* B.) Lafayette, Ind., *Lillian Snyder*.

26*c*. On *Sporobolus asper* (Mx.) Kunth. (*Vilfa aspera* B.) Lafayette, Ind., *Arthur*.

26*d*. On *Sporobolus asper* (Mx.) Kunth. (*Vilfa aspera* B.) · Rockport, Kans., *Bartholomew*.

ORIG. DESC. "Puccinia Sydowiana Diet. n. sp.—Sori teleutosporiferi in foliis amphigeni, elliptici vel oblongi, in vaginis plus minusve lineares, pulvinati, atri. Teleutosporæ oblongæ, ellipticæ vel clavatæ, utrinque rotundatæ, rarius basi attenuatæ, medio leniter constrictæ, episporio levi, castaneo, apice paullo, vel non incrassato instructæ, 38-55×18-30μ, pedicello usque 100μ longo, firmo, flavescenti suffultæ."

SYN:

Puccinia sydowiana Diet. (1897. Hedw. 36: 299).

II. Sori amphigenous, oblong or linear-oblong, scattered, rarely confluent, tardily naked, deep orange color when fresh; spores obovate, obovate-fusiform, oblong or sub-globose, 22-30×28-32μ; wall colorless, usually much thickened apically (up to 10μ), evenly papillose; contents orange, becoming colorless by long desiccation; pores obscure (seemingly equatorial).

III. Sori amphigenous, prominent, black, early naked, ruptured epidermis inconspicuous, oblong, or elongated-oblong; teleutospores mostly oblong, rarely clavate or round, slightly or not constricted at the middle, apex rounded, rarely flattened but often obtuse, usually more or less thickened, base rounded, epispore smooth, dark brown, 18-30×38-55μ; pedicel up to 100μ long, firm, tinted especially near the spore.

A very clearly marked and easily distinguishable species, quite unlike *Puccinia cryptandri* and *P. sporoboli*, which also occur on species of *Sporobolus*.

Collections of this species have often been erroneously referred to *P. sporoboli*. In 1897 Dietel published a description of the species under the name *P. sydowiana*. This name, unfortunately, was already occupied, having been used by Zopf (1880. Sydow, Myc. Marchica, No. 40) for a species of rust on *Lophanthus nepetoides*, since referred to *P. glechomatis* DC., according to Sydow (Saccardo, Sylloge fung., 12: 643). Before the publication of Dietel's name an herbarium name, *P. vilfæ*, had been adopted by Ellis and Tracy, and specimens distributed under it, but no description was published. As the publication of Zopf's species (with full description) invalidates Dietel's name, we substitute the name of *P. vilfæ*, the appropriateness of which has already been recognized.

A specimen in the herbarium of the U. S. Division of Veg. Phys. and Path. at Washington, D. C., collected by S. M. Tracy in Mississippi on *S. asperifolius* belongs to this species.

EXSIC.

Ellis and Everhart, N. A. F. 2417, 3570.
Ellis and Everhart, Fungi Columb. 48, 1189.
Sydow, Ured. 1032.
Seymour and Earle, Econ. Fungi Supp. B 19.

---

27. PUCCINIA STIPÆ *Arth.* (1884. Bull. Iowa Agric. Coll. 160.)

27*a*. On *Stipa spartea* Trin. Decorah, Iowa, *Holway*.
27*b*. On *Stipa spartea* Trin. Spirit Lake, Iowa, *Arthur*.
27*c*. On *Stipa spartea* Trin. Spirit Lake, Iowa, *Arthur*.

ORIG. DESC. "II. Sori oblong, small, mostly on the upper surface of the leaf, yellowish, inconspicuous, tardily naked; uredospores yellow, round to oblong or ovate, minutely roughened and with or without very fine points, 15 to 20 mmm. broad by 20 to 30 mmm. long.

III. Sori oblong, scattered over the upper surface of the leaf, very dark brown, soon naked; encircling epidermis inconspicuous; teleutospores oblong or less commonly oblong-obovate, smooth, brown, considerably constricted at the middle, 18 to 25 mmm. broad by 42 to 56 mmm. long; apex thickened, or sometimes thin, rounded to obtuse, sometimes acutish; base obtuse or somewhat narrowed; pedicel slightly colored, two to three times as long as the spore."

Usually a very abundant species on the prairies of the Northwest. The uredospores are evenly warty, sometimes weakly echinulate, and have six to eight irregularly distributed pores.

The same species occurs on *Stipa comata* T. & R. in Montana (*Anderson* No. 158, and *Seymour*) and North Dakota

(*Seymour*) and on *S. capillata* L. in Bohemia (*Hora*), so far as one can be sure of the identification of the species by comparison of teleutospores alone.

The names *P. graminis foliorum stipæ* Opiz (1852. Seznam Rost. Kvet. Ceské, p. 138) and *P. stipæ* Hora (1889. Sydow's Ured. No. 28) are both *nomina nuda*, and according to present usage are therefore to be excluded from the synonymy.

EXSIC.

Sydow, Uredineen, 28.
Rabenhorst-Winter Pazschke, Fungi Europæi 3918.
Ellis and Everhart, N. A. F. 2245.

28. PUCCINIA SUBSTERILIS (*E. & E.*) (1895. Bull. Torr., Bot. Cl., 22:58.)

28*a*. On *Stipa viridula robusta* Vasey. Hot Springs, N. M., *Holway*.

ORIG. DESC. "On *Chrysopogon** *sp.* Fort Collins, Colo., March, 1894 (C. F. Baker, No. 219).

Mostly hypophyllous, Sori (II. and III.) superficial, pulvinate, elliptical, black-brown, ½-1 mm. long, naked. Uredospores echinulate, globose or elliptical, 20-30×18-22 μ, brownish-black, epispore nearly equally thickened throughout; pedicels slender, hyaline, subpersistent, 20-32 μ long. Teleutospores (in the same sori as the uredospores), oblong or clavate, pale, constricted at the septum, 22-30×12-15 μ, epispore smooth, mostly not at all or only slightly thickened at the rounded or subtruncate apex.

The uredospores are abundant and well developed, while the teleutospores are few in number and apparently not well matured."

SYN:

Uredo luxurians E. & E. (1898. North Amer. Fungi, Cent. XXXVI, No. 3583.)

II. Sori mostly epiphyllous, but also to some extent on the leaf sheaths, and toward the base of the blade hypophyllous, oblong or sometimes elongated, prominent, early naked, the ruptured epidermis not especially noticeable, brownish-black; uredospores elliptical to globular, sometimes obovate or subtriangular, 26-30 × 20-30 μ, dark brown; epispore thick, strongly echinulate; pores 4-6, scattered, lateral; pedicel sub-persistent, hyaline, usually about the length of the spore, but sometimes 75-100 μ.

---

*Examination of original material shows the host to have been *Stipa viridula* Trin., and not a *Chrysopogon*.

III. Teleutospores (intermixed with the uredospores) brownish yellow, oblong or obovate, smooth, $30\text{-}37 \times 16\text{-}20 \mu$, much constricted at the middle; apex thickened, rounded or obtusely pointed; base rounded, sometimes narrowed; pedicel slightly tinted, delicate, usually not exceeding the length of the spore, but sometimes much longer.

On *Stipa viridula* Trin. Hot Springs, N. M., E. W. D. Holway, Sept. 13, 1896; Valley City, N. D., A. B. Seymour, Aug. 25, 1884; Fort Collins, Colo., C. F. Baker, March, 1894 and March, 1896, C. S. Crandall, 1898.

The specimens gathered at the three widely separated stations show no evident differences. Teleutospores, not abundant, and even entirely wanting in part of the Colorado collections, are much like those of *Puccinia stipæ*, but smaller. No exclusive teleutosori were seen. The very remarkable uredospores have considerable resemblance to teleutospores, and among them in each collection can be found a few uredospores of a more common type, but which show all gradations to the form characteristic of the species. The pores are readily seen in most cases without treatment.

The same host is said by Seymour (List of fungi collected in 1884 along the N. Pac. railroad, *Proc. Boston Soc. Nat. Hist.* 24:188) to bear *Puccinia stipæ*, but examination of the original material, five packets, kindly loaned by Mr. Seymour, shows that the host in all the collections, which was doubtfully referred at the time to *Stipa viridula* (misprinted *S. viridis*), is really *S. comata*, and that the rust is the true *P. stipæ* as stated in the published list. The specimen cited above, which was collected by Mr. Seymour upon the same journey, is not referred to by him in his list. It consists of four fragments of leaves from 5 to 8 cm. long, and some of the inflorescence. It has been for some years, and is still in the Arthur herbarium.

EXSIC.

Ellis and Everhart, N. A. F. 3141, 3583.

---

29. PUCCINIA GRAMINELLA (*Speg.*) *Diet. & Holw.* (1895. Erythea 3:80.)

29*a*. On *Stipa eminens* Cav. Berkeley, Calif., *Blasdale and Holway*.

ORIG. DESC. "Maculæ nullæ; pseudosporangia amphigena lineatim, interrupte laxeque disposita, primo subglobosa, clausa dein elongato-cylindracea (0.5-0.7''' long × 0.15-0.25''' crass.) apice irregulariter ac frustulatim lacero-dehiscentia, albo-flavescentia, tenui membranacea, contextu parenchymatico, e cellulis subhexagonis elongatis (30-40×15-20), hyalino-flavidis, levibus composito; sporæ sphæricæ (20-24), episporio crassissimo, dense ruguloso-striolato, protoplasmate amoene aurantiaco, grosse guttulato.

Hab. ad folia viva Stipæ speciei cujusdam vulgatissimum prope Bonariam, vere, 1880."—Spegazzini, Fungi Arg. 4:32.

SECOND DESC. "Spots yellow or purplish. Æcidia and teleutospores epiphyllous. Æcidia arranged to oblong groups or lineally extending along the veins of the leaves. Pseudoperidia persistent, irregularly bursting, composed of oblong cells. Æcidiospores elliptical or ovoid, 21-29×18-21 μ, epispore thick, colorless, verrucose or striolate. Teleutospores: sori elongated, pulvinate, dark brown; spores hardly constricted at the septum, thickened above, smooth, brown, 35-48×22-28 μ. Pedicels stout, longer than the spores.

On *Stipa eminens*, at Berkeley, Alameda Co., Calif., May, 1894, leg. Holway and Blasdale."

SYN:

Æcidium graminellum Speg. (1881. Fungi Argentini pug. IV, p. 32.)

This rust is unique among grass and sedge forms in bearing the æcidial stage upon the same host as that bearing the third stage. In spite of both stages being upon the same host the æcidium was known and described some time before the other was found, which fact accords with the usual history of grass rusts. It seems that the teleutosporic form must be very rare or even wanting in South America, as it has not been found by Spegazzini (l. c.) in Argentine, or in Chili by Neger (Engler's Bot. Jahrb. 22:351). The species does not appear to produce uredospores.

The æcidiospores are evenly and closely papillate, and as usual are more or less angular from compression. They are more often globose than elliptical or ovoid as given in the second description.

The gathering for this distribution provided the characters for the second description of the fungus, being the first time that teleutospores were known, and consequently it determined the genus. The material of the distribution is, therefore, part of the type material for the second description.

A good illustration of the æcidium cup with accompanying teleutospores is given by Dietel in Engler & Prantl's Pflanzenfamilien (1:66).

EXSIC.

Ellis and Everhart, N. A. F. 3350.
Ellis and Everhart, Fungi Columb. 864.

---

30. PUCCINIA POCULIFORMIS (*Jacq.*) *Wettst.* (1885. Verhl. Zool.-Bot. Ges. Wien –:544).

30*a*. On *Triticum vulgare* L. Decorah, Iowa, *Holway*.
30*b*. On *Triticum vulgare* L. Falcon Valley, Wash., *Suksdorf*.
30*c*. On *Triticum vulgare* L. Lafayette, Ind., *Arthur*.
30*d*. On *Triticum repens* L. (*Agropyron repens* Beauv.) Geneva, N. Y., *Arthur*.
30*e*. On *Triticum caninum* L. (*Agropyron caninum* R. & S.) Camp Badger, Calif., *Holway*.
30*f*. On *Avena sativa* L. Rockport, Kans., *Bartholomew*.
30*g*. On *Avena fatua* L. Decorah, Iowa, *Holway*.
30*h*. On *Agrostis vulgaris* With. (*A. alba vulgaris* Thr.) Decorah, Iowa, *Holway*.
30*i*. On *Agrostis scabra* Willd. (*A. hiemalis* B. S. P.) Cambridge, Mass. *Pammel*.
30*j*. On *Dactylis glomerata* L. Decorah, Iowa, *Holway*.
30*k*. On *Hordeum jubatum* L. Spirit Lake, Iowa, *Arthur*.
30*l*. On *Hordeum jubatum* L. Rooks Co., Kans., *Bartholomew*.
30*m*. On *Hordeum jubatum* L. Decorah, Iowa, *Holway*.
30*n*. On *Hordeum jubatum* L. City of Mexico, Mex., *Holway*.
30*o*. On *Hordeum murinum* L. Camp Badger, Calif., *Holway*.
30*p*. On *Elymus canadensis* L. Rooks Co., Kans., *Bartholomew*.
30*q*. On *Berberis vulgaris* L. Lafayette, Ind., *Arthur*.
30*r*. On *Berberis vulgaris* L. Decorah, Iowa, *Holway*.

ORIG. DESC. "Initio maji in dorso foliorum Berberis vulgaris macula flava prodit, tandem in faciem usque penetrans; hic semper plana, illic vero in verrucam convexam magis minusve elata; ex qua emergunt funguli aggregati minutissimi aurantiaci, in principio subrotundi, dein, dum augentur, magis ovati *a*, rarius obverse ovati *b*, tum oblongi cum aperto apice *c*, et tandem cylindrici cum margine crenato et pallente *d*; figuris hisce in icone ad lentem auctis. Ad hunc usque marginem fungulus impletur substantia solida et aurantiaca, quae maturata solvitur tota in pulverem subtilissimum concolorem, excussum ex cylindris folia ipsa applentem. Rarissime illos in foliorum facie proprona observavi; nonnunquam pedicellos et calycem denso agmine circumdare vidi. Solitarium dumtaxat unum alterumve inveni. In sola Berberi huc usque occurrit, nec in alio ulto vicino frutice. Maturescunt mense Junio. Valde accedit ad Lycoperdon penicilliforme Florae Danicae."

SECOND DESC. "P. graminis, conferta, lineari-effusa, clavulis turbinatis. tab. III. fig. 31 (cop. in fol. graminis)."—Persoon, Tent. Dis. Meth. Fung. p. 39.

SYN:

Lycoperdon poculiforme Jacq. (1786. Coll. Austr. 1:122.)
Lycoperdon lineare Schrank. (1789. Baier. Fl. 2:669.)
Æcidium berberidis Gmel. (1791. Linné Syst. Nat. cura Gmelin 2:1473.)
Puccinia graminis Pers. (1797. Tent. Dis. Meth. Fung. p. 39.)
Puccinia culmorum Schum. (1801. Enum. Saell. 2:233.)
Puccinia jubata Ell. & Barth. (1896. Erythea 4:2.)

I. Æcidia on more or less thickened and discolored spots, usually in small groups, but when upon growing lateral shoots often covering large areas; margin prominent, white, erect, more or less jagged; æcidiospores orange-yellow, becoming pale yellow after long desiccation, isodiametric, polygonal, 14-24 μ in diameter; wall rather thin, smooth, or sometimes rugulose especially upon one side.

II. Sori large, oblong to linear, amphigenous, either scattered or confluent into rather large, definite groups, more usually found on the leaf-sheaths, soon naked, ruptured epidermis prominent, ferruginous; uredospores elliptic-oblong or obovate, often somewhat constricted in the middle, 19-38 × 14-22 μ, brownish-yellow when fresh, becoming yellow with desiccation, echinulate; pores usually four, equatorial.

III. Sori sparingly on leaf-blades, more commonly on sheaths, culms and inflorescence, linear, often confluent, black, early naked. ruptured epidermis noticeable; teleutospores oblong-fusiform, oblong-cuneiform, or narrow obovate, 35-60 × 12-22 μ, golden-brown, smooth, somewhat constricted in the middle; apex darker colored, considerably thickened, obtuse or rounded; base narrowed; pedicel usually barely as long as the spore, firm, colored like the spore.

Among the most common of rusts, although by no means so abundant and inclusive as has been assumed up to within the last few years. It is much less common upon the leaf blades than are other species of rusts, but is frequently seen upon the culms and sheaths, forming conspicuous black, effused patches. The form of the uredospores and the number and arrangement of the pores are characteristic, and readily distinguish the species from some others that are most likely to be confounded with it. The uredospores when fresh have a decidedly brownish color, quite unlike the clear orange yellow of those of *Puccinia rhamni* and *P. rubigo-vera*.

The connection of the æcidium upon barberry, as one of the stages in the life cycle of the rust, is one of the best established facts in the biology of the *Uredineæ*. As there is always a possibility that the conclusions drawn from work done upon European material may not be applicable to what are assumed to be the same species in America, it is worth while to mention that the connection in this case has also been established with American material. In the spring of 1889 H. L. Bolley, working in the botanical laboratory of Purdue University, sowed sporidia from germinating teleutospores from wheat upon the leaves of the common barberry, and as a consequence secured æcidia; this was successfully repeated several times. Other American botanists have undoubtedly made cultures, of which the most extensive are probably those of M. A. Carleton, whose results are now in process of publication by the U. S. Department of Agriculture, as part of the work of the Division of Veg. Physiology and Pathology.

In making up the present fascicle only forms have been included under *Puccinia poculiformis* which the authors have strong reasons for believing are assuredly a part of it. The uredospores found among the teleutospores of the gathering upon *Triticum repens* are somewhat smaller than those taken from wheat stems, and even the teleutospores seem a little smaller. But cultures made by Charles B. Plowright of King's Lynn, England, fully establish the identity of the material. In the spring of 1884 material gathered in the same locality as that secured two years later for the present distribution was sent to Mr. Plowright. The record of his experiment runs as follows: "Exp. 384. A seedling Barberry plant infected on 21 May with germinating spores of Puccinia graminis on Triticum repens sent by Mr. J. C. Arthur from Geneva, U. S. A.—30 May spermogonia appeared, 5 June æcidia, 22 the accompanying leaves gathered.—King's Lynn, 22, 6, '84. Charles B. Plowright." Four leaves of barberry with fully developed æcidia, together with the memorandum, are now in the Arthur herbarium. There seems to be no reason, in view of these facts, to doubt that the form on *Triticum repens* is correctly referred to *P. poculiformis*.

In regard to the gatherings on *Agrostis*, both on *A. vulgaris* and *A. scabra*, the chance for reasonable doubt is more pronounced. Both uredo and teleutospores are much smaller than in typical material, and the form of the teleutospores is clearly at variance, being less slender and pointed. Only partial experimental evidence is available in this case. Cultures with the uredospores from the culms of *Agrostis alba* were made by Wm. Stuart during July, 1898, in the botanical laboratory of Purdue University. The leaves of wheat plants infected with the spores July 6 showed characteristic pustules and spores on July 21. The uredospores from the original material, as well as the accompanying teleutospores, agreed in size and appearance with those in this distribution (plate VI, figs. 30*h* and 30*i*), measuring 19-26 by 14-17 μ. The resulting uredospores grown on the wheat leaves measured 22-33 by 20-22 μ, which is a return to the typical size of the species. This would indicate that the undersize of the spores on species of *Agrostis* is due largely to inferior nutrition afforded by the host.

The form on *Hordeum jubatum* has been separated as a distinct species under the name *Puccinia jubata* E. & B. Through the kindness of Mr. Bartholomew, whose zeal, open-mindedness and liberality have placed us under the deepest debt of gratitude, we have received part of the type material used for the description of the species, and also a recent gathering of the same form for use in the accompanying distribution (301). Comparison of this material with other collections on *Hordeum jubatum* and *H. murinum* and with material on *Triticum*, *Agrostis* and other hosts, accepted as genuine *Puccinia poculiformis*, shows no valid morphological reason, so far as we can see, for keeping the forms apart. The uredospores may be slightly smaller than on *Triticum*, and the teleutospores, as pointed out by the describers, slightly less robust, but they do not vary as much from the *Triticum* standard as does the form on *Agrostis*. Some additional proof of identity is afforded by cultures conducted by Wm. Stuart in the Purdue University laboratory during the present season. Sowings of uredospores, from *Hordeum jubatum* growing in the vicinity, made upon the leaves of wheat, formed uredosori in eight days, and later upon the leaves of barley in seven days, showing abundant typical development, and with no failures or contaminations. The cultures were made during August.

In citing exsiccati the same rule is followed as in selecting material for the distribution; only such specimens are mentioned as the authors deem to be beyond question referable to the species.

EXSIC:

Ellis, N. A. F. 1010^{I}.
Carleton, Ured. Amer. 9^{III}, 29^{II}, $^{\text{III}}$.
Sydow, Ured, 267^{I}, 268^{I}, 372^{I}, 517^{I}, 518^{I}, 771^{I}, 772^{I}. 871^{I}, 19^{III}, 119^{III}, 519^{III}, 570^{III}, 721^{III}, 770^{III}.
Seymour and Earle, Econ. Fungi 84, 85, 86*a*, 86*b*, 87*a*, 87*b*.
Vize, Fungi Brit. 8^{III}, 76^{I}.
Linhart, Fungi Hung. 34^{III}, 126^{I}.
Allescher and Schnabl, Fungi bav. 414^{III}, 24^{I}.
Thuemen, Myc. univ. 29^{I}.
Krieger, Fungi sax. 211^{I}.
Jaczewski, Komarov and Tranzschel, Fungi Ros. Exsic. 18^{I}.

31. PUCCINIA RHAMNI (*Pers.*) *Wettst.* (1885. Verhl. Zool.-Bot. Ges. Wien —:545).

31*a*. On *Avena sativa* L. Decorah, Iowa, *Holway*.
31*b*. On *Avena sativa* L. Lafayette, Ind., *Arthur*.
31*c*. On *Avena fatua* L. Decorah, Iowa, *Holway*.
31*d*. On *Rhamnus lanceolata* Pursh. Lafayette, Ind., *Arthur*.
31*e*. On *Rhamnus alnifolia* L. Her. Racine, Wis., *Davis*.

ORIG. DESC. "*Æcidium rhamni*. 2. Aethecis cylindricis roseis; seminibus aurantiis. Persoon."

SECOND DESC. "3. P. coronata: Tab. 11. fig. 96. acervulis linearibus, brevibus, minutis, obscure-fuscis, epidermide palescente cinctis; sporis sessilibus, subclavatis, apice dentibus acutis stellato-radiatis flammeis coronatis, infra luteis. Long. spor. 0,00175. p. p. Hab. in foliis Luzulæ albidæ prope Reichenberg."—Corda, Icones **1**:6.

SYN:

Æcidium rhamni Pers. (1791. Linné Syst. Nat. cura Gmelin **2**:1472.)

Puccinia coronata Cda. (1837. Icones fung. **1**:6.)

I. Æcidia on somewhat thickened definite spots on lower side of leaf, occasionally causing considerable distortions, especially when on young fruit and shoots, at first orange, becoming nearly colorless with age; margin erect, somewhat erosed; æcidiospores orange-yellow, becoming pale yellow with age, isodiametric or somewhat elongated, polygonal, 16-24μ in diameter; wall thin, minutely granulose.

II. Sori of medium size, oblong to linear, amphigenous, occasionally on sheaths and stems, scattered, rarely confluent, but sometimes clustered, soon naked, orange color, ruptured epidermis prominent; uredospores globose, with some admixture of obovate-globose, 22-30μ in diameter; wall colorless, thin, obscurely echinulate; pores four or more, scattered; contents orange when fresh, becoming yellow with desiccation.

III. Sori amphigenous, but more abundant on under side of blade, less common on sheaths and stems, scattered, irregularly oblong, partly punctiform, covered with the persistent epidermis, grayish-black; teleutospores subclavate to linear-oblong, 35-60 by 15-18μ, brown, slightly or not constricted; wall thin, smooth; apex not much thickened, but produced into finger-form projections, either erect or more or less inclined, corona-like; base somewhat narrowed; pedicel very short or obsolescent.

This is a species the limits of which are not readily established; but only what is thought to be typical material has been placed in the present fascicle, leaving other collections for future study and reference.

The connection of the æcidium was established by sowings made in the greenhouses of Purdue University in June, 1898. The æcidiospores from *Rhamnus lanceolata* were placed upon the first leaves of seedling oats on June 2, and on June 10 the first sori appeared. By June 29 four leaves showed an ample growth of characteristic sori, and no instances of sori outside the infected areas appeared. Although the leaves died before time enough had elapsed for teleutospores to form, yet the results, taking into account the microscopic examination and the absence of all indication of accidental contamination, may be accepted as conclusive. We have no opinion to offer at the present time regarding Klebahn's separation into two species of the forms which have previously passed under the name *Puccinia coronata*. So far as the material presented in this fascicle is concerned, we believe that it all belongs to one species, and that it is rightly referred to *Puccinia rhamni*.

The synonymy, so far as European publication is concerned, is not of great moment in the present connection, but attention may be called to an American name. In Berkeley's "Notices of North American Fungi" (Grev. 3:61) is described *Æcidium pulcherrimum* Rav. on *Berchemia*, as follows: "Pseudoperidia occupying the whole surface, snow white, cylindrical, obtuse, at length open, edge not radiated." F. W. Anderson (Jour. Myc. 6:121) considered this to be identical with *Æ. crassum* Pers. and *Æ. rhamni* Pers. Examination of material in Ravenel's Fungi Car. Exsic. No. 726 (specimen in the herbarium of the Iowa Agricultural College) shows no certain morphological distinction between it and the usual collections upon *Rhamnus*. The specimen similarly labelled in Ellis and Everhart's North Am. Fungi No. 2712 does, however, possess what appears to be the specially marked character in the original description: a distinctly cylindrical or elongated peridium. The peridia in this specimen are over a half millimeter long. No other divergent characters are evident. But in a specimen upon *Rhamnus cathartica* received from L. H. Pammel and collected at Parkersburg, Iowa, and also one on *Rhamnus frangula* in Linhart's Fungi Hungarici, No. 329, not only are the peridia remarkably long, but the spores are conspicuously large, measuring 18-26 μ. The form on *R. frangula* is undoubtedly the one called by Link (*Handbuch* 3:446) *Cæoma rhamnatum*, said to have "Becher lang, oft herausfallend," and to be distinct from *Æ. crassatum* found on various species of *Rhamnus*. It seems probable from the above facts that the elongated peridium and larger spores are not permanent characters, but depend upon some condition of growth. It may be accepted, therefore, that *Æ. pulcherrimum* Rav., so far as morphological characters can show, is to be considered a synonym of *Puc. rhamni;* but the cultural side of the question still remains to be investigated.

EXSIC.

Ellis, N. A. F. 269.
Ellis and Everhart, N. A. F. 1821.
Seymour and Earle, Econ. Fungi 78*a*, 78*b*.
Sydow, Ured. 420, 513, 563, 716, 767.
Vize, Fungi Brit., 116, 155.
Krieger, Fungi sax., 473.
Allescher and Schnabl, Fungi bav. 116.

32. PUCCINIA SORGHI SCHW. (1834. N. Am. Fungi: 295.

32*a*. On *Zea mays* L. Decorah, Iowa, *Holway*.
32*b*. On *Zea mays* L. Decorah, Iowa, *Holway*.
32*c*. On *Zea mays* L. City of Mexico, Mex., *Holway*.

ORIG. DESC. "2910. 6. P. SORGHI L. v. S., frequens in foliis Sorghi et Zeæ cult. Bethl.

P. emaculata. Acervis latis difformibus rarie lobatis, primum epidermide tectis, demum denudatis sed in margine cinctis et tum epidermide lacerata. Acervis saepe etiam, quasi versus centrum internum lobatis-2-4 lineas longis latisque. Majores acervi ad nervos foliorum occurrunt. Sporidiis aterrimis grossis breviter pedicellatis."

II. Sori amphigenous, round or oblong, tardily naked, ruptured epidermis prominent, brown; uredospores globose to elliptical, brown, 26-32 by 22-28 μ; wall rather thin, echinulate, colored; pores 4, placed irregularly, but inclined to be equatorial.

III. Sori amphigenous, round or oblong, tardily naked, ruptured epidermis prominent, 1-2 mm. long, brownish black; teleutospores oblong or elliptical, sometimes obovate, golden brown, 30-37 by 17-26 μ, somewhat constricted at middle, smooth; apex obtuse or rounded, moderately thickened; base rounded, less frequently somewhat narrowed; pedicel tinted, not very firm, usually equalling the spore, but sometimes twice as long.

A common species, but not so abundant as the extensive cultivation of the host plant would lead one to expect. The uredospores upon drying become depressed at the pores, and take on a sub-angular outline.

EXSIC.

Ellis, N. A. F. 268.
Ravenel, F. Car. Ex. 92.
Seymour and Earle, Econ. Fungi 72.
Sydow, Ured., 921.
Linhart, Fungi hung. 27.
Thuemen, Myc. univ. 231, 321*b*.
Rabenhorst, Fungi europæi 2172.
Ellis and Everhart. Fungi Columb. 257.

---

33. PUCCINIA ATRA *Diet. & Holw.* (1897. Bot. Gaz. 24:29.)

33*a*. On *Setaria grisebachii* Fourn. Rio Hondo near City of Mexico, Mex., *Holway*.

ORIG. DESC. "Sori mostly hypophyllous; uredosori mostly linear, up to 5 mm. long, naked, pulverulent, cinnamon-brown; spores elliptical or ovate, 27-35 by 21-25 μ, closely covered with small warts, brown: teleutosori punctiform or linear, scattered or clustered, naked, black; spores elliptical, rounded at both ends, scarcely constricted, smooth chestnut-brown, apex with hooded thickening (about 5 μ), 31-38 by 21 26 μ; pedicel rather firm, up to 85 μ long, hyaline, often brownish next the spore."

The uredospores of this species are thin-walled, minutely and evenly papillose, and have four germ pores, equatorially arranged and nearly equidistant, but not readily seen without the use of acid. In form the spores range from globose to broadly ovate. The apical thickening of the teleutospores is not a prominent feature, and is often essentially absent.

34. PUCCINIA SETARIÆ *Diet. & Holw.* (1897. Bot. Gaz. 24:28.)

34*a*. On *Setaria imberbis* (Poir) R. & S City of Mexico, Mex., *Holway*.

ORIG. DESC. Sori mostly epiphyllous, elliptic or sublinear; uredosori cinnamon-brown, naked; spores elliptical or almost globose, sometimes angular, 28-38 by 22-29 μ, with a thick closely verrucose epispore, and 6-8 germ-pores, dirty yellow-brown; teleutosori pulvinate, black; spores elliptical or obovate, rarely fusiform, not at all or only rarely constricted, rounded at both ends, rarely conical at apex, 35-48 by 24-33 μ, epispore smooth, chestnut-brown, apex with a broad hooded thickening (7.5-13 μ); pedicel thick, firm, up to 100 μ long, hyaline or pale brown."

There is a marked correspondence between this species and *Puccinia atra*, both in gross and minute characters. The appearance of the sori of both uredo and teleutoforms, the form and color of the teleutospores, and the form and surface markings of the uredospores are quite alike in both species, but show a little stronger development in *P. setariæ*, even to the papillæ on the uredospores. The two species are clearly distinct, however, as shown by the number and arrangement of the germ pores of the uredospores.

In *P. setariæ* the teleutospores are more inclined to an elliptical or obovate form with greater thickening of the apex. The uredospores are thicker walled, with coarser papillæ, and with scattered germ pores, usually six in number.

ERRATUM.

The parenthesis enclosing authority for the name of No. 28 on page 390 should be cancelled; the correct writing for the name is *Puccinia substerilis* E. & E.

EXPLANATION OF PLATES.

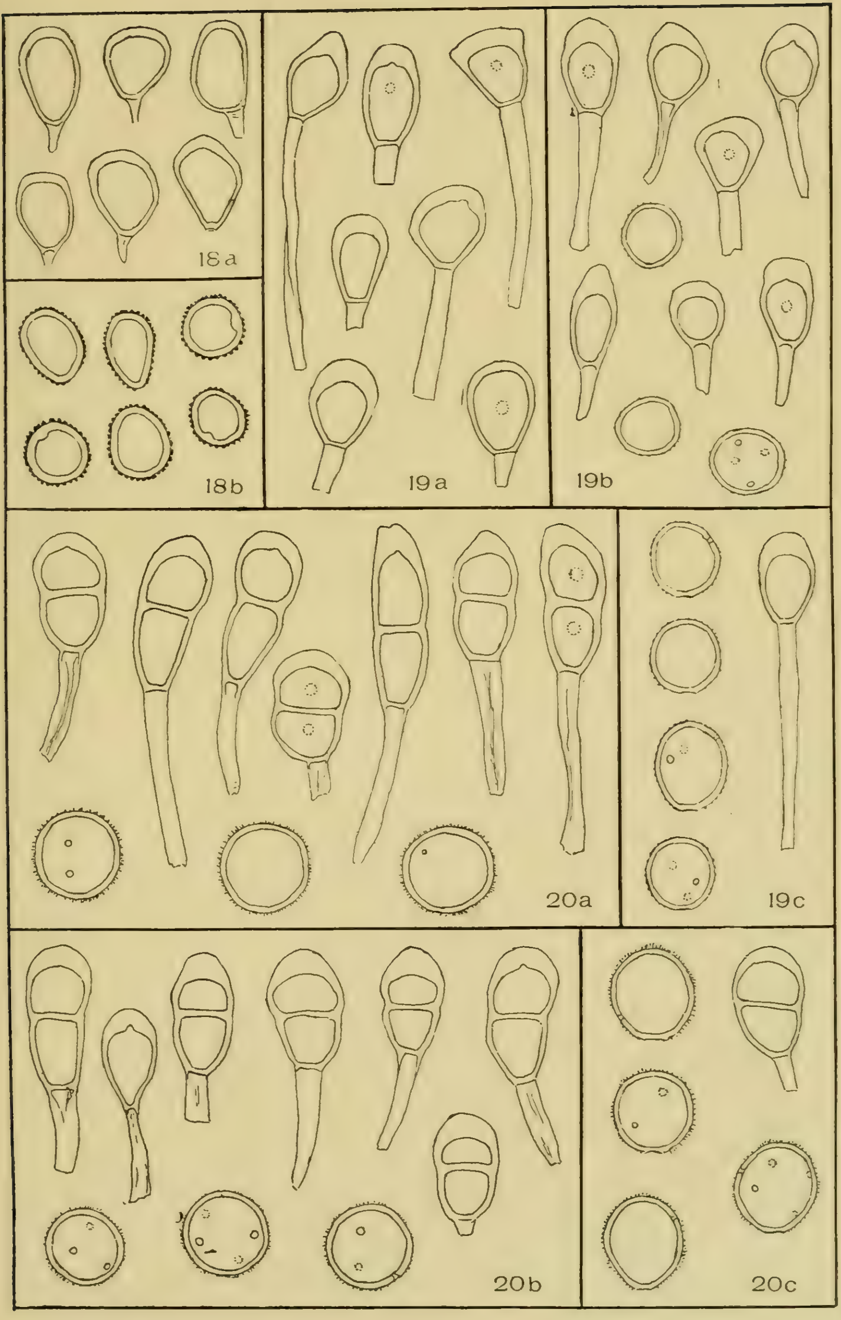
The drawings have been made from a Zeiss microscope bearing a D objective and No. 8 compensating ocular, and by the use of an Abbe camera lucida. They are uniformly drawn to a magnification of 625 diameters, and reduced in engraving to 470 diameters. The essentially correct dimensions of the spores may be obtained from the plates by multiplying the measurements taken in millimeters by two, the results being in mucros (μ).

The pores shown for the uredospores do not always represent the full number, but only those that were evident. When the scar on the uredospores left by the fall of the pedicel is shown, it is placed lowermost.

EXPLANATION OF PLATE IV.

18*a*. *Uromyces alopecuri* Seym.—Six teleutospores.
18*b*. " " " —Six uredospores.
19*a*. " *graminicola* Burr.—Seven teleutospores.
19*b*. " " " —Seven teleutospores and three uredospores.
19*c*. " " " —One teleutospore and four uredospores.
20*a*. *Puccinia panici* Diet.—Seven teleutospores and three uredospores.
20*b*. " " " —Seven teleutospores and three uredospores.
20*c*. " " " —One teleutospore and four uredospores.

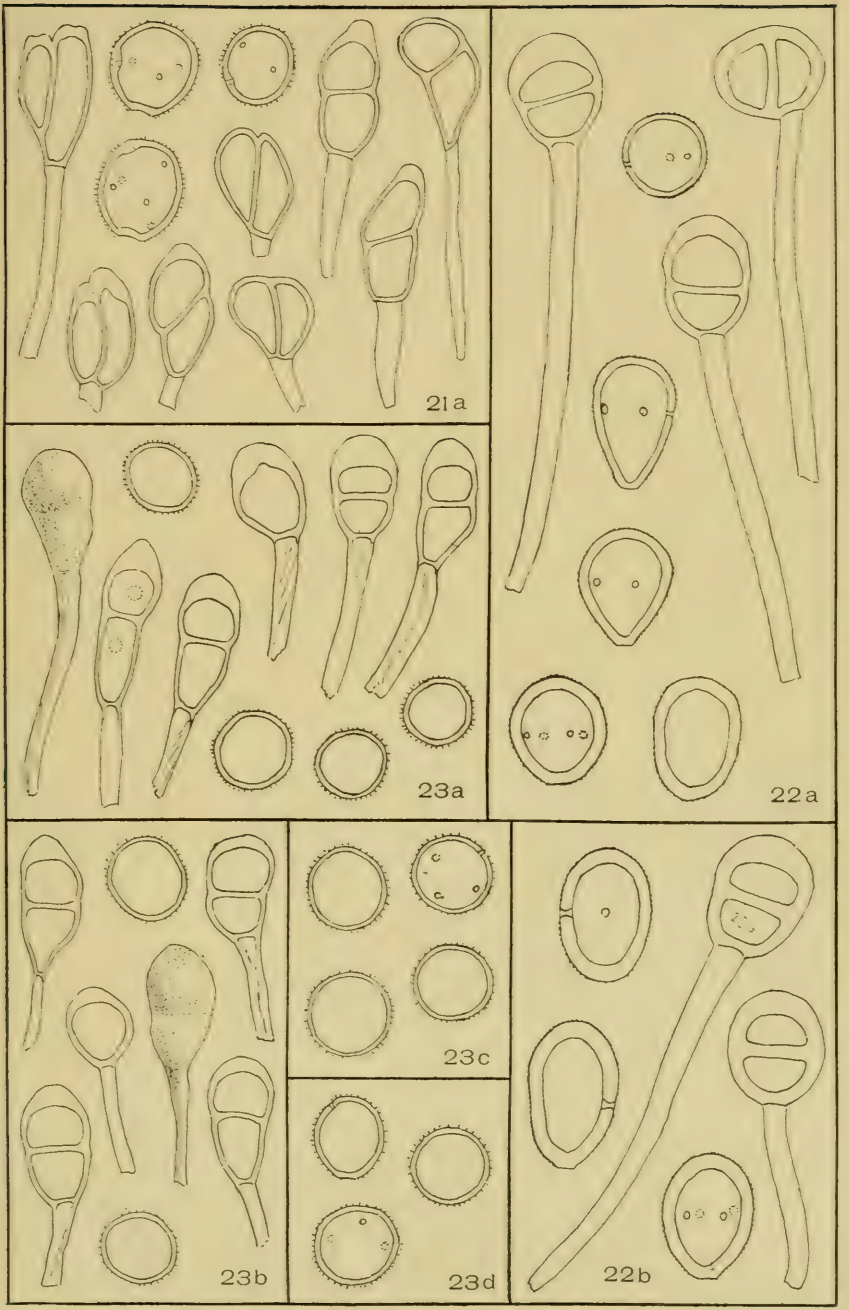
PLATE IV.


18a
18b
19a
19b
20a
19c
20b
20c

EXPLANATION OF PLATE V.

21*a*. *Puccinia flaccida* B. & Br.—Eight teleutospores and three uredospores.
22*a*. “ *esclavensis* D. & H.—Three teleutospores and five uredospores.
22*b*. “ “ “ —Two teleutospores and three uredospores.
23*a*. “ *emaculata* Schw.—Six teleutospores, one being drawn as if opaque, and four uredospores.
23*b*. “ “ “ —Six teleutospores, one being drawn as if opaque, and two uredospores.
23*c*. “ “ “ —Four uredospores.
23*d*. “ “ “ —Three uredospores.

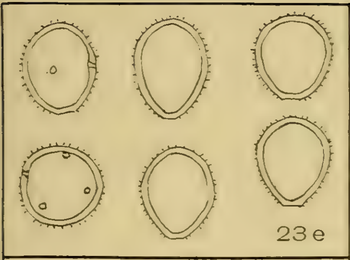
PLATE V.

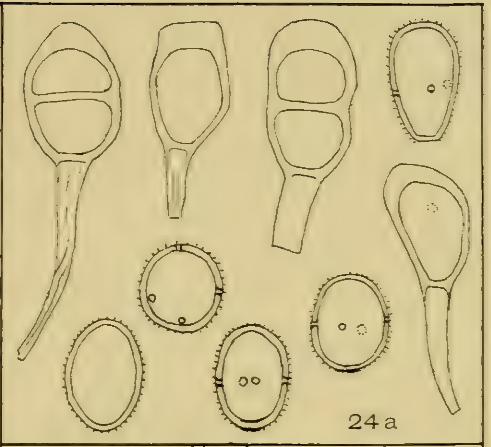

21a
23a
22a
23b
23c
23d
22b

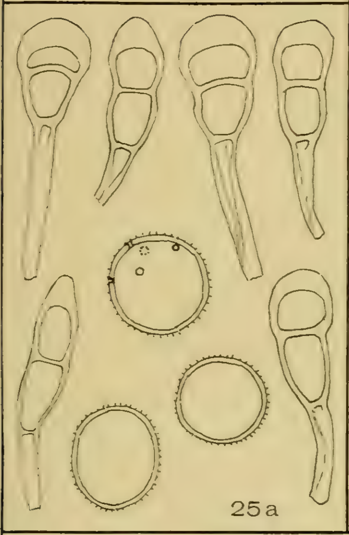
EXPLANATION OF PLATE VI.

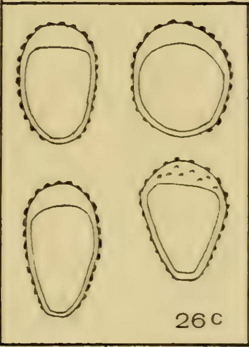
23*e*. *Puccinia emaculata* Schw.—Six uredospores.
24*a*. " *cryptandri* E. & B.—Four teleutospores and five uredospores.
25*a*. " *sporoboli* Arth.—Six teleutospores and three uredospores.
26*a*. " *vilfæ* Arth. & Holw.—Four teleutospores and three uredospores.
26*b*. " " " —Five teleutospores.
26*c*. " " " —Four uredospores.
26*d*. " " " —Four uredospores.

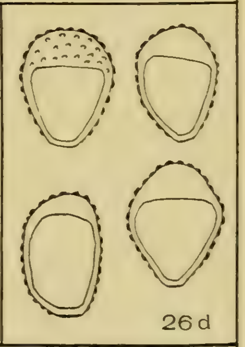
PLATE VI.

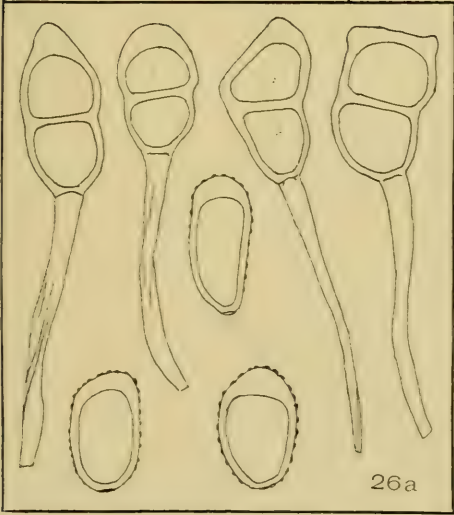

23 e

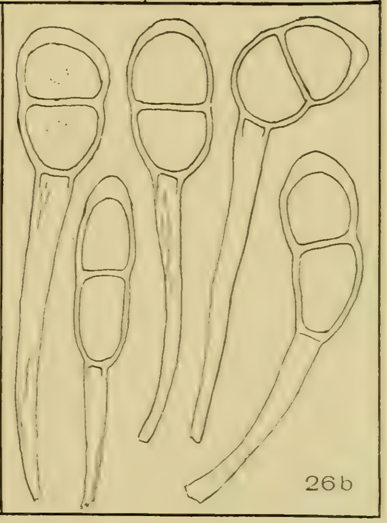

24 a


25 a


26 c


26 d


26 a


26 b

EXPLANATION OF PLATE VII.

27*a*. *Puccinia stipæ* Arth.—Four teleutospores and two uredospores.

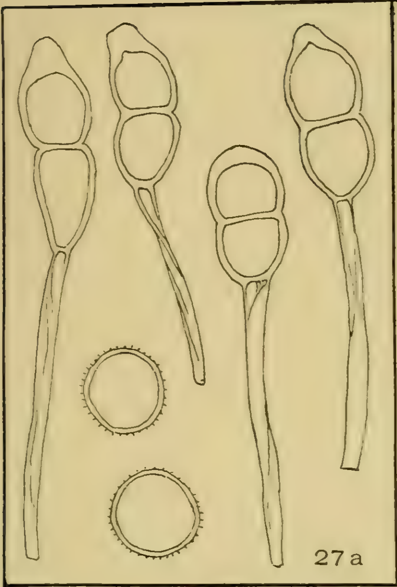
27*b*. " " " —Five teleutospores and two uredospores.

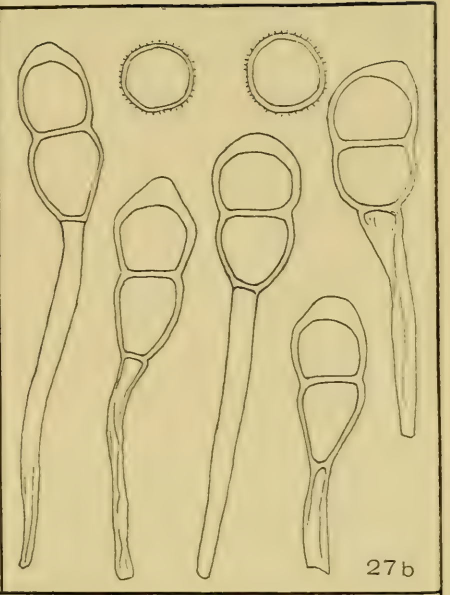
27*c*. " " " —One teleutospore and five uredospores.

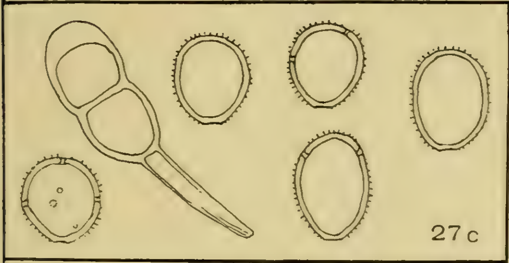
28*a*. " *substerilis* Ell. & Ev.—Four teleutospores, five uredospores with pedicels, and two uredospores without pedicels.

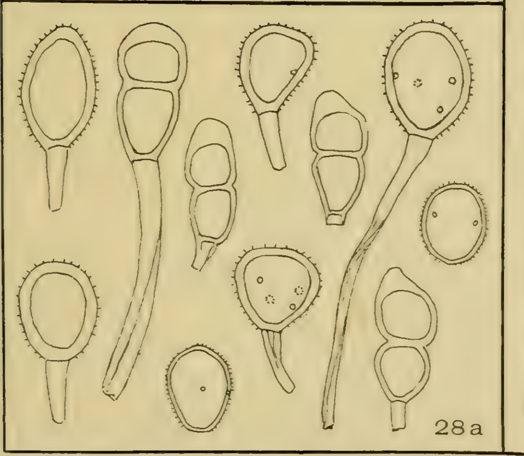
29*a*. " *graminella* (Speg.) D. & H.—Four teleutospores and five uredospores.

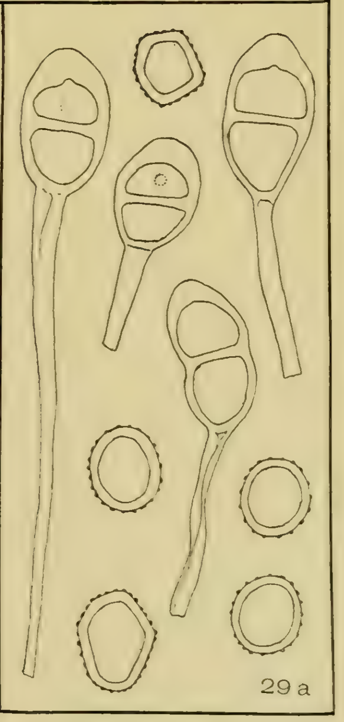
PLATE VII.


27a


27b


27c


28a


29a

EXPLANATION OF PLATE VIII.

30*a*. *Puccinia poculiformis* (Jacq.) Wettst.—Seven teleutospores and four uredospores, one being drawn as if opaque.

30*b*. " " "—Four teleutospores and four uredospores.

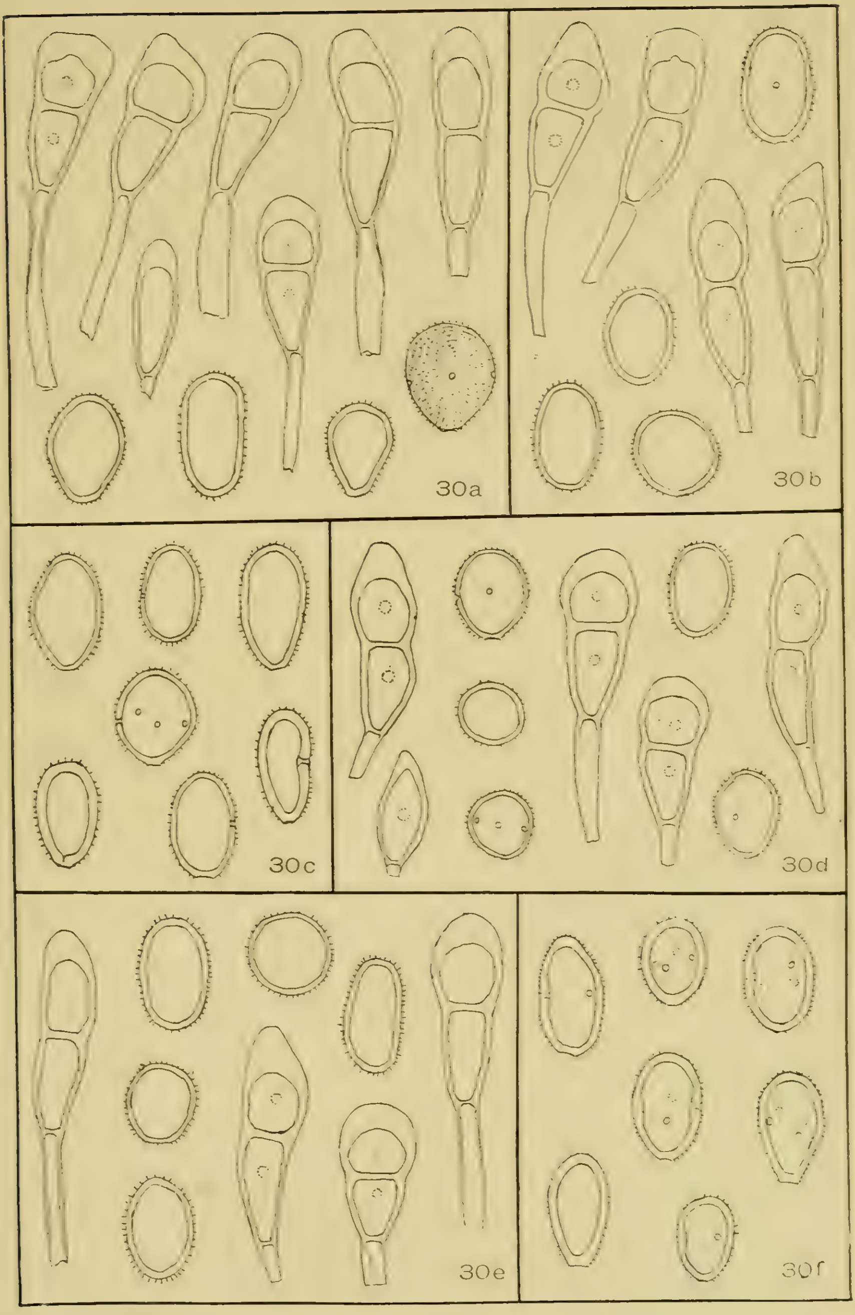
30*c*. " " "—Seven uredospores.

30*d*. " " "—Five teleutospores and five uredospores.

30*e*. " " "—Four teleutospores and five uredospores.

30*f*. " " "—Six uredospores.

PLATE VIII.


30a
30b
30c
30d
30e
30f

Explanation of Plate IX.

30*g*. *Puccinia poculiformis* (Jacq.) Wettst.—Four teleutospores and two uredospores.

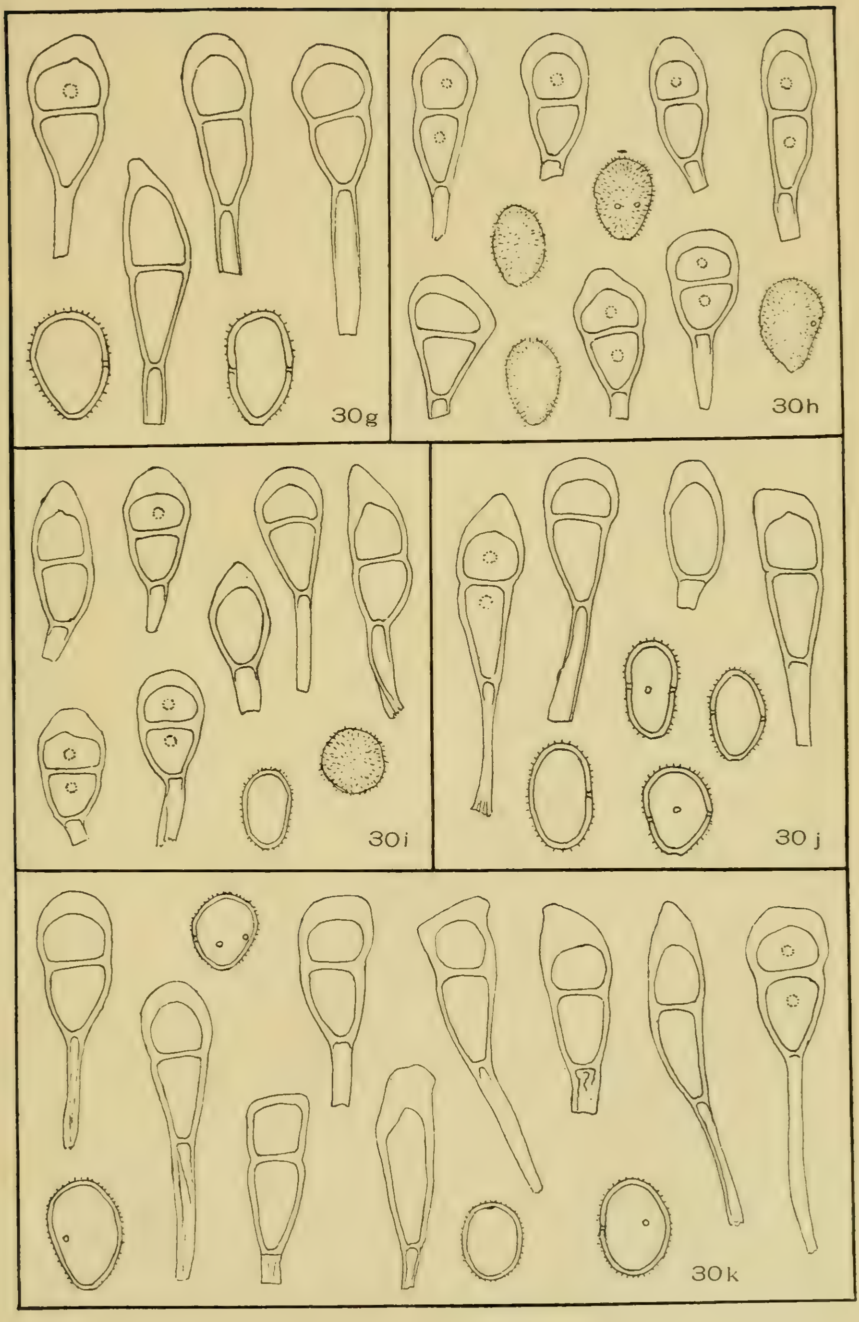
30*h*. " " "—Seven teleutospores and four uredospores, the latter drawn as if opaque.

30*i*. " " "—Seven teleutospores and two uredospores, one of the latter being drawn as if opaque.

30*j*. " " "—Four teleutospores and four uredospores.

30*k*. " " "—Nine teleutospores and four uredospores.

PLATE IX.


30g
30h
30i
30 j
30k

EXPLANATION OF PLATE X.

30*l*. *Puccinia poculiformis* (Jacq.) Wettst.—Four teleutospores and three uredospores.

30*m*. “ “ “ —Three teleutospores and four uredospores.

30*n*. “ “ “ —Four teleutospores, and five uredospores.

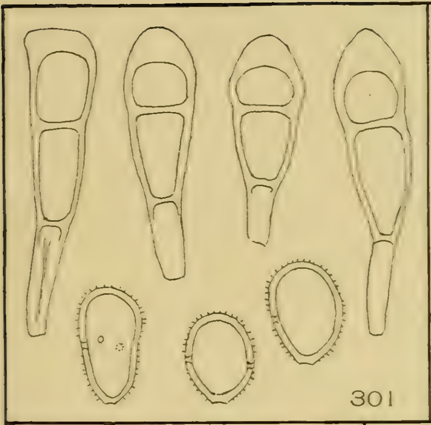
30*o*. “ “ “ —Six teleutospores and six uredospores.

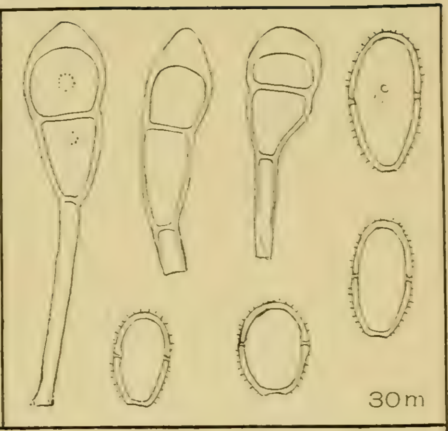
30*p*. “ “ “ —Two teleutospores and one uredospore.

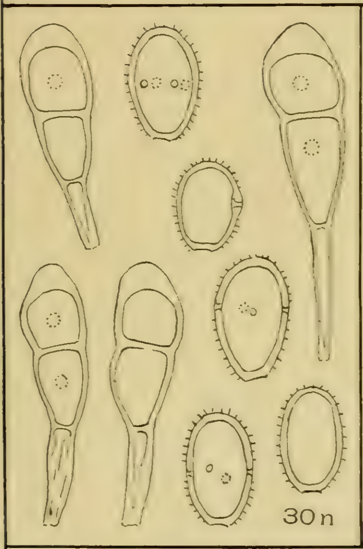
30*q*. “ “ “ —Five æcidiospores and two peridial cells.

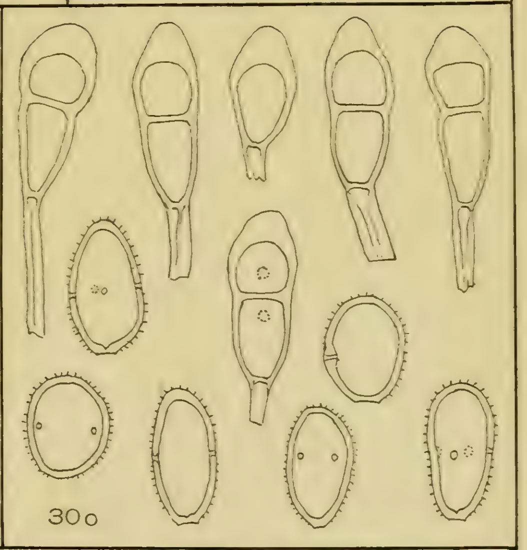
30*r*. “ “ “ —Five æcidiospores and two peridial cells.

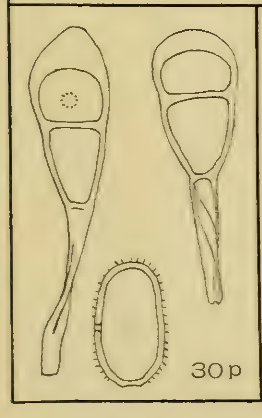
PLATE X.

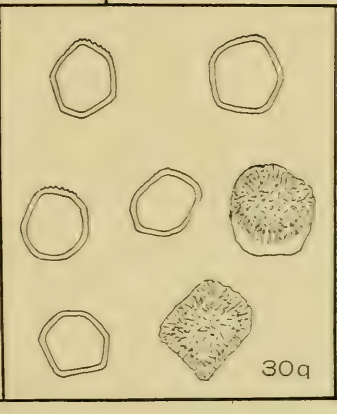

30 l

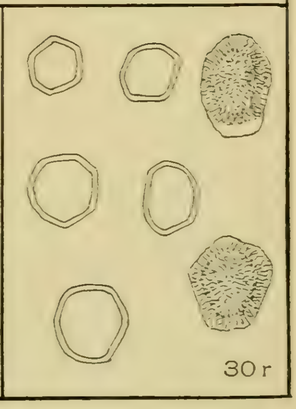

30 m


30 n


30 o


30 p


30 q


30 r

EXPLANATION OF PLATE XI.

31*a*. *Puccinia rhamni* (Pers.) Wettst.—Eleven teleutospores and three uredospores.

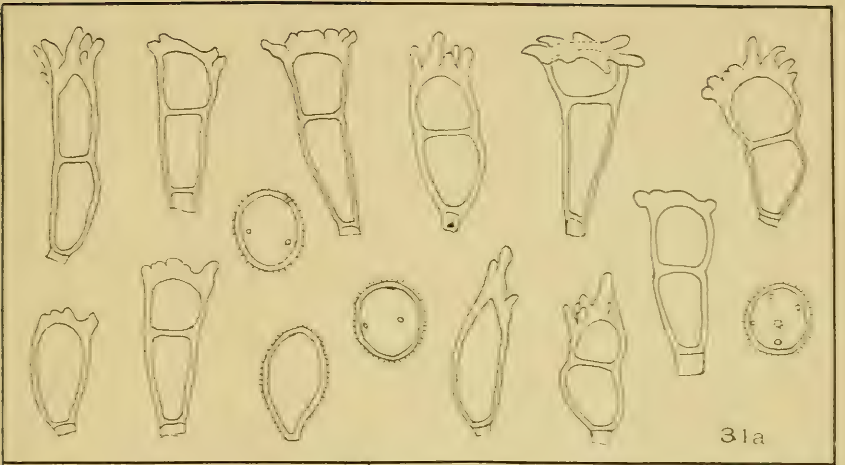
31*b*. “ “ “ —One teleutospore and seven uredospores.

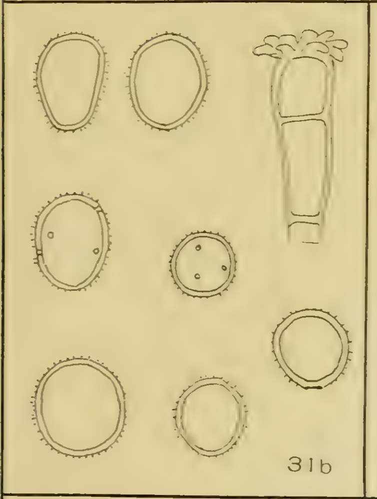
31*c*. “ “ “ —Five teleutospores and four uredospores.

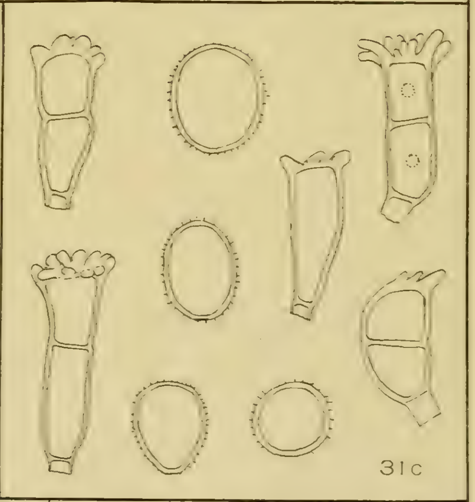
31*d*. “ “ “ —Seven æcidiospores and two peridial cells.

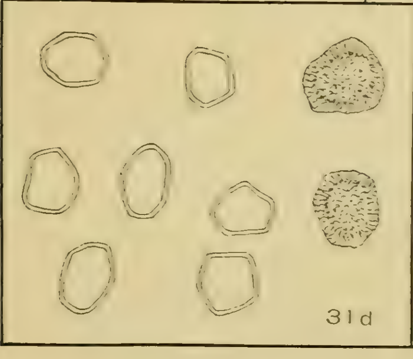
31*e*. “ “ “ —Seven æcidiospores and two peridial cells.

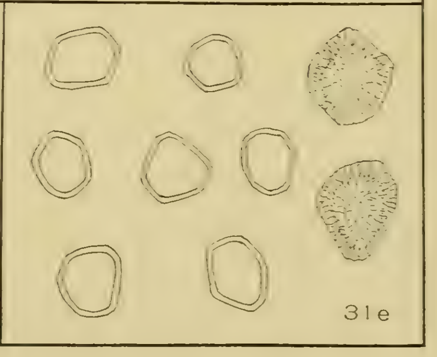
PLATE XI.


31a


31b


31c

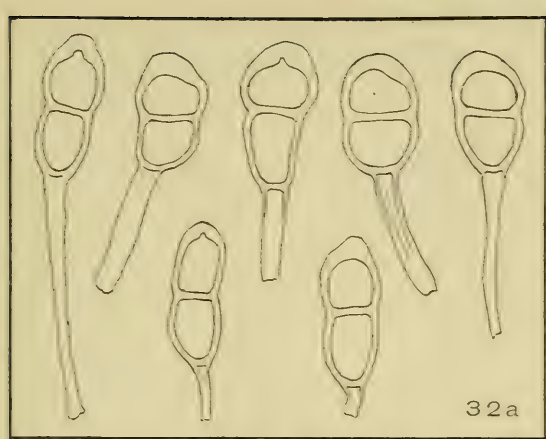

31d

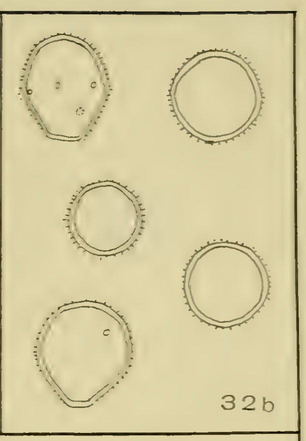

31e

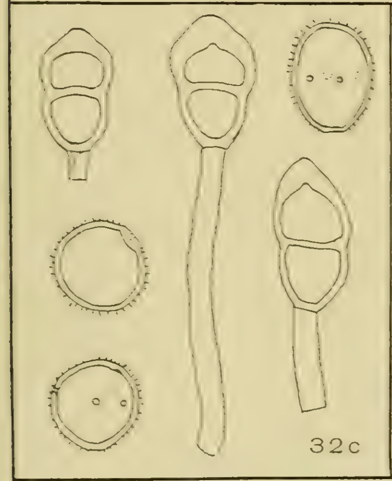
EXPLANATION OF PLATE XII.

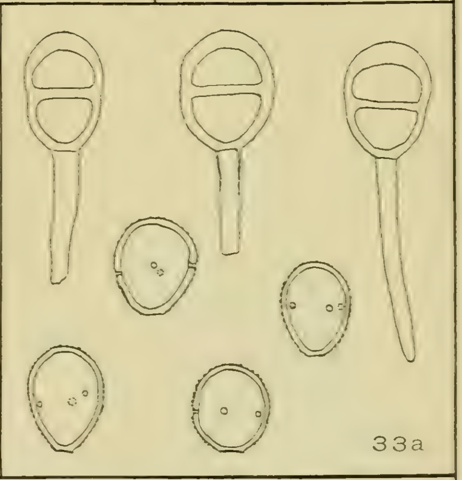
32*a*. *Puccinia sorghi* Schw.—Seven teleutospores.
32*b*. " " "—Five uredospores.
32*c*. " " "—Three teleutospores and three uredospores.
33*a*. " *atra* D. & H.—Three teleutospores and four uredospores.
34*a*. " *setariæ* D. & H.—Five teleutospores and four uredospores.

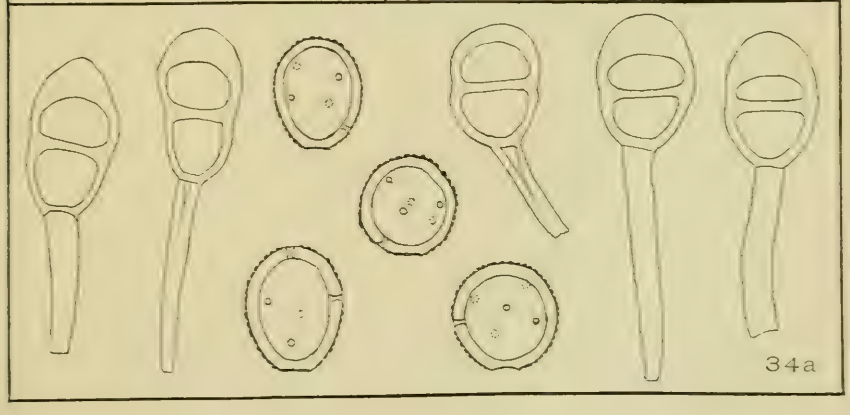
PLATE XII.


32a


32b


32c


33a


34a

This Bulletin, as all the preceding, is sent free to all institutions and individuals from whom the University of Iowa receives similar publications in exchange; to other recipients the price will be fifty cents, about the cost of publication.

The earlier numbers are no longer to be supplied.

New York Botanical Garden Library
3 5185 00280 1395